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The SHORAD Requirement of the Armored Cavalry Regiment

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Final report 6 June 1975

A thesis presented to the faculty of the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027

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The problem addressed in this thesis is to determine the short range air defense (SHORAD) requirement of the armored cavalry regiment (ACR) against low altitude air attack. Based upon an analysis of recent Mideast wars, unrestricted, modern aerial weaponry has the capability to neutralize the maneuver and effectiveness of the ACR. The large and sophisticated Soviet threat consists of 4,500 high performance aircraft and heliborne forces. COL A. A. Sidorenko's book The Offensive provides significant insight into Soviet air attack priorities. In terms of regimental assets, Soviet air attack priorities are: (1) howitzer batteries as nuclear capable weapon systems; (2) tank companies as local reserves; (3) command posts; (4) armored cavalry troops.

THE SHORAD REQUIREMENT OF THE

ARMORED CAVALRY REGIMENT

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements of the degree

MASTER OF MILITARY ART AND SCIENCE

by

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Fort Leavenworth, Kansas
1975

ABSTRACT

The problem addressed in this thesis is to determine the short range air defense (SHORAD) requirement of the armored cavalry regiment (ACR) against low altitude air attack. Based upon an analysis of recent Mideast wars, unrestricted, modern aerial weaponry has the capability to neutralize the maneuver and effectiveness of the ACR. The large and sophisticated Soviet threat consists of 4,500 high performance aircraft and heliborne forces. COL A.A. Sidorenko's book The Offensive provides significant insight into Soviet air attack priorities. In terms of regimental assets, Soviet air attack priorities are: (1) howitzer batteries as nuclear capable weapon systems; (2) tank companies as local reserves; (3) command posts; (4) armored cavalry troops.

As a target, the ACR consists of at least 26 critical assets ranging from small command posts and troop/company/battery-sized units to the large regimental field trains. Before determining the SHORAD requirement, the regiment's organic passive and active air defense measures must be maximized and evaluated. Passive air defense can be the primary air defense for command posts, combat trains and dispersed armored cavalry troops; they are least effective for helicopter assembly areas, the regimental field trains, and howitzer batteries. The majority of the regiment's huge potential for small arms for air defense (SAFAD) is found in the 9 armored cavalry troops. Using the volume fire technique, SAFAD can provide effective final defensive fires capable of destroying Soviet aircraft or degrading their bombing accuracy. In

conjunction with passive air defense, SAFAD provides the armored cavalry troop adequate air defense. Redeye, as the organic SHORAD capability of the regiment, complements SAFAD. A full Redeye section can adequately defend one critical asset, with the exception of the regimental field trains.

Using a desert (Fort Bliss) scenario as a vehicle, the regiment's SHORAD shortfall in a corps advance covering force mission is examined. Each asset is analyzed by determining its criticality to the mission, priority for Soviet air attack, ability to avoid detection (passive air defense), SAFAD capability (self-defense), vulnerability to aircraft ordnance, and recuperability. Based upon this analysis, the regimental commander's air defense priorities are: (1) howitzer batteries; (2) tank companies; (3) regimental field trains; (4) regimental and squadron command posts.

After maximizing the regiment's organic passive and active air defense measures, an air defense shortfall remains which requires a minimum of 12 Chaparral/Vulcan (C/V) platoons in view of current air defense doctrine. This requirement equates to a C/V battalion. Further analysis establishes that the SHORAD requirement is best met by the divisional-type C/V battalion which has an airspace control element (ACE), and an optimal mix of 2 Chaparral/2 Vulcan (SP) batteries.

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CHAPTER I: INTRODUCTION

BACKGROUND

The basic research for this thesis began in 1972 after the 3d Armored Cavalry Regiment (ACR) had completed its summer move from Ft Lewis, WA, to Ft Bliss, TX, the home of the U.S. Army Air Defense Center and School. The new desert training environment of the 3d ACR offered, for the first time, the kind of training area which permitted the frontages and depths envisioned by the regiment's designers in its missions as a corps reconnaissance and security force. The regiment's interaction between Ft Bliss' 11th Air Defense Group, in particular, the group's 5th Battalion, 59th Air Defense Artillery (C/V), and the Air Defense School resulted in fully integrated command post (CPX) and field training exercises (FTX) which were unique in their scope. The research of scanty existing doctrine by both air defense artillerymen and cavalrymen in preparation for these exercises, and the real world problems of organization and equipment discovered during the CPXs and FTXs, provide an invaluable data base for refining and improving air defense of the ACR from low altitude air attack. However, the Ft Bliss experience is that of a training environment and should be tempered, where appropriate, by the combat experience of recent Arab/Israeli conflicts and the current Soviet low altitude air threat.

The Mideast (Yom Kippur) War of October 1973 erupted as the 3d ACR, 11th AD Group, and other Army and Air Force units were deploying

in the New Mexican desert for the U.S. Readiness Command (USREDCOM) Joint Training Exercise (JTX) Brave Shield VI. As pointed out in the unclassified forward of a comprehensive, SECRET U.S. Army study,

> The 1973 Mideast War affords the most recent in-depth view of contemporary mid-intensity war. Soviet doctrine and tactics were used by the Arab forces, but the full range of conventional armaments available to the United States and the Soviets were not used ....[1]

Although not a complete picture, the Mideast War of 1973 offers significant insight into a high technology war. The Egyptian war effort certainly reflected this use of technology. Remembering the awesome destruction wrought by the Israeli Air Force (IAF) in the Six Day War of 1967, the Soviet trained and equipped Egyptians were able to preclude the IAF from decisive air attack that would have prevented their October '73 crossing of the Suez Canal and consolidating the east bank.[2] Using similar Soviet air defense tactics and equipment in the Golan Heights, the Syrians were able to exact a high price of Israeli aircraft until the IAF finally neutralized their air defenses.[3] The apparent success of the Arab air defenses awakened the U.S. Military community at large from its lethargy concerning air defense. At Ft Bliss, the 3d ACR and air defense interaction was further stimulated, many of the lessons already learned were reinforced, and a basis for new experimentation under field conditions was provided.

In addition to the unique experience of the 3d ACR/11th AD Gp at Ft Bliss and the analysis of Mideast conflicts, the air defense community at large has provided additional thinking through recent articles in military journals and official publications, many inspired by the Mideast War of 1973. These articles and publications reflect an awareness on the part of air defenders to foster a closer working relationship

with maneuver unit commanders. Much productive effort is being devoted to improve and expand upon existing air defense doctrine, organization, and equipment.

THE PROBLEM

The fundamental problem, addressed by combat and combat support commanders alike, is whether the Army can accomplish its tactical missions under low altitude air attack on a fluid, modern battlefield. To address this problem, a need exists to examine in detail what short-range defense (SHORAD) requirements for a combat unit exist once organic passive and active air defense capabilities have been maximized. The required mix and quantity of air defense unit SHORAD systems such as Chaparral and Vulcan must be determined. Concerning SHORAD employment, the ground tactical commander must know how to determine and express his air defense priorities in meaningful terms to his air defense commander; the air defender must understand the tactical requirements of the units he is supporting.

From a corps commander's perspective, SHORAD requirements must be addressed for each type of maneuver unit that may comprise his force--all types of divisions, the separate mechanized or armored brigade, the air cavalry combat brigade, and the armored cavalry regiment. This thesis will address one of these units as follows:

TO DETERMINE THE SHORAD REQUIREMENTS OF THE ARMORED CAVALRY REGIMENT AGAINST LOW ALTITUDE AIR ATTACK.

Although narrowed in focus to the armored cavalry regiment, wider application can be logically extended to other corps units. For example, the 49 helicopters of the regiment equal the number of heli-

copters employed tactically by the armored or mechanized infantry division. The tank/artillery mix organic to the regiment is comparable to the separate armored brigade or the armor-heavy brigade of the division with its normal combat support. The frontages and depths of the regiment in a normal corps mission are equal to or greater than those of divisions. With these considerations in mind, the armored cavalry regiment can offer clues to the SHORAD requirements of other corps maneuver units.

While the primary objective of this thesis is to determine the SHORAD requirements of the ACR and to recommend appropriate doctrinal, organizational, and equipment changes, secondary objectives are as follow:

- Assist cavalry commanders in determining and articulating their air defense priorities in terms meaningful to air defense commanders.

- Provide air defense commanders a better understanding of the SHORAD requirements of a deployed ACR.

DEFINITIONS AND ABBREVIATIONS

Certain key terms and abbreviations must be explained at the outset; others will be defined in the appropriate chapter. Unofficial abbreviations that are not found in AR 310-50, Authorized Abbreviations and Brevity Codes or JCS Pub. 1, Department of Defense Dictionary of Military and Associated Terms, but commonly used are:

ACR--Armored Cavalry Regiment

C/V--Chaparral/Vulcan air defense systems

SAFAD--Small Arms for Air Defense

Abbreviations authorized by AR 350-50 and defined on page 2-1, FM 44-1, are as follow:

HIMAD--High-to-medium-altitude air defense (HIMAD) is provided by long-range weapons that are deployed in small numbers to cover relatively large areas.[4] This role is currently filled by the Nike Hercules weapon system.

LOMAD--Low-to-medium-altitude air defense (LOMAD) is provided by medium-range weapons. The capabilities of systems employed in this role fill the gap between HIMAD and SHORAD. This role is currently filled by the towed and self-propelled Hawk weapon systems.[5]

SHORAD--Short-range air defense (SHORAD) is provided by quick-reacting weapons designed to counter that portion of the very low-altitude air threat to the field army that underflies LOMAD coverage. They are deployed in large numbers and are employed under highly decentralized control concepts. This role is currently filled by Chaparral, Redeye, and ADA automatic weapons (AW) (M42, M55, Vulcan). The role may be subdivided into the low-altitude forward area air defense (LOFAAD) role, currently filled by the Chaparral and ADA AW organizations; and the man-portable air defense (MANPAD) role, currently filled by Redeye units ....[6]

JCS Pub. 1 provides the following definitions vital to the discussion.

Air superiority--That degree of dominance in the air battle of one force over another which permits the conduct of operations by the former and its related land, sea, and air forces at a given time and place without prohibitive interference by the opposing force. (p. 18)

Active air defense--Direct defense action taken to destroy attacking enemy aircraft or missiles, or to nullify or reduce the effectiveness of such attack. It includes such measures as the use of aircraft, interceptor missiles, air defense artillery, nonair defense weapons in an air defense role and electronic countermeasures and counter-countermeasures. (p. 2)

Passive air defense--All measures, other than active defense, taken to minimize the effects of hostile air action. These include the use of cover, concealment, camouflage, deception, dispersion, and protective construction. (p. 224)

Vital area--A designated area or installation to be defended by air defense units. (p. 317) (FM 44-1, p. 7-3, discusses the defense of a small unit such as a company/troop/battery as a variation of a vital area defense.)

METHODOLOGY

As currently organized and equipped, the armored cavalry regiment has never been subjected to an air parity or enemy air superiority environment. For this reason, the determination of the SHORAD requirement of the ACR must draw heavily upon the unique training lessons of the 3d ACR at Ft Bliss and the combat experience of the Mideast War of 1973. For the purpose of this thesis, the framework for determining the regiment's SHORAD requirements will be a desert scenario, with appropriate map graphics. As a function of current doctrine, organization, and equipment, the scenario will be tempered by the Ft Bliss and Mideast experiences.

Chapter II will define the Soviet low altitude air threat based upon an unclassified analysis of the Mideast wars of 1967 and 1973, current Soviet aircraft, and The Offensive, an enlightening book written by Colonel A.A. Sidorenko of the Soviet Army.

Chapter III will discuss existing air defense doctrine that pertains to the armored cavalry regiment, describe the ACR as a target in terms of its critical assets, and analyze its organic means of passive and active air defense. Chapters II and III establish the framework necessary for the analytical process of Chapter IV.

Utilizing map graphics, Chapter IV will portray the armored cavalry regiment in a conventional warfare, Ft Bliss desert scenario. The typical ACR mission selected--as a corps advance covering force in a movement to contact--is similar to many actually exercised by the 3d ACR in Ft Bliss FTXs. Consequently, theoretical aspects of time and distance factors are considerably reduced. The scenario provides for the

difficult task of protecting a dispersed, rapidly moving armored formation. The desert environment was chosen because the difficulty of passive air defense measures and the detection of targets by attacking aircraft are maximized, thus becoming a worst case situation. Additionally, both Ft Bliss training and Mideast warfare offer desert experience directly compatible with the desert scenario.

The desert scenario of Chapter IV will provide the vehicle for a systematic analysis of the priorities of the ACR commander, and the employment and effectiveness of his passive and active air defense measures. The shortfall of air defense for regimental critical assets will determine the SHORAD requirement for Chaparral/Vulcan weapon systems and their interface with organic regimental systems.

Chapter V will provide a summary of the conclusions reached in previous chapters and the pertinent recommendations that result.

The major research questions to be investigated are as follow:

- What is the low altitude air threat and its significance to the ACR?

- What must be defended from low altitude air attack on a deployed ACR?

- What effective passive air defense measures are available to the ACR?

- What organic means does the ACR have to conduct an active air defense?

_ How does the ACR commander determine his priorities for air defense protection?

- What SHORAD shortfall exists which could be met by an air defense unit?

- What size and type air defense unit is required?

- How well do organic ACR and air defense unit assets complement and interface with each other?

SCOPE AND DELIMITATIONS

For the purpose of this study, the analysis of active air defense is limited to SHORAD (Chaparral/Vulcan/Redeye) systems and small arms for air defense. The use of aircraft, HIMAD (Nike Hercules) and LOMAD (Hawk) missile systems, electronic countermeasures, and counter-countermeasures in the air defense role are beyond the scope of this thesis. In effect, this analysis deals only with the requirement for those air defense systems which operate within the regiment's zone of action and are directly responsive to the regimental commander. The threat considered is that of Soviet low altitude attack aircraft and helicopters as opposed to the threat posed by high-level bombers or surface to surface missiles.

The scope of this study does not include the complex area of airspace management. However, as the interface of air defense capabilities are discussed, some of the communications necessary for adequate integration of air defense systems may also be those required for airspace management.

Unclassified sources provided ample materials for valid thesis research and analysis. The basic research materials pertaining to current air defense doctrine and the unique 3d ACR training at Ft Bliss are unclassified. Concerning the Mideast wars of 1967 and 1973, excellent unclassified sources are available which provide valuable information. Of significant value was the unclassified translation of

COL A.A. Sidorenko's The Offensive, which provides new insight into Soviet doctrine.

ENDNOTES

[1]U.S. Army Combined Arms Center, "Foreward (U)," Analysis of Combat Data--1973 Mideast War (U) (Ft Leavenworth: U.S. Army, 1974), p. vi.

[2]John Barry and others (eds.), Insight on the Middle East War (London: André Deutsch Limited, 1974), p. 83.

[3]Ibid., p. 94.

[4]The SAM-D air defense missile system, presently in development, will eventually replace both the Nike Hercules and Hawk weapon systems.

[5]Ibid.

[6]The Chaparral missile system will be replaced by the recently purchased Roland system. Redeye will eventually be replaced by the Stinger missile system which is presently in development.

CHAPTER II: THE LOW ALTITUDE AIR THREAT

GENERAL LESSONS FROM THE MIDDLE EAST

The "Six Day War" of 1967

Referring to the Arab-Israeli "Six Day War" of 1967, Moshe Dayan declared that "The key to the Campaign was the Air Force."[1] S.L.A. Marshall reinforced this view by saying, "... for the first time, air power won a war."[2]

The record was truly impressive. The world press printed stunning photos of vast columns of smoking tanks and trucks in such places as the Mitla Pass.[3] Within 48 hours, through preemptive air strikes, the Israeli Air Force (IAF) had destroyed 2/3 of the Egyptian Air Force[4] and broken the back of Nasser's army of 100,000 men.[5] By the end of that fateful six days, Israeli tankers were able to race across the Sinai to the east bank of the Suez while fighting brief, fierce battles against demoralized Egyptians. Meanwhile, as General Hod the IAF commander put it, "We hacked them continuously."[6]

Two fundamentally important lessons from the Six Day War emerge for the armored unit commander. The first lesson is that without air defense to counter sophisticated air attack, the ground commander's maneuver can be seriously hampered. Israeli General Rabin emphasized that air strikes destroyed Egyptian mobility and prevented two massive Egyptian counterattacks.[7] An example was the 14th Egyptian Brigade which was pinned down by air strikes and unable to counterattack.[8]

The second major lesson is the tremendous destructive power of the modern fighter-bomber. It is commonly accepted that the world-acclaimed, U.S.-built F-4 (Phantom) of the IAF can achieve such destruction, but the weaponry of the French Mysteres and Mirages, for example, contributed their share as seen in the following quote.

> From Nakhl the conflagration and carnage wrought by bombs, cannon, and napalm stretched eastward almost as far as Themed. Death Valley, the troops were calling it.[9]

The vulnerability of tanks to modern air weaponry is clearly evident. S.L.A. Marshall, while enroute to Bir Hasne to visit battlefields immediately after the Israeli victory, observed at one location alone, 51 Egyptian tanks destroyed by air strikes.[10] U.S.-built Pattons of Jordan suffered a similar fate.[11]

An effective summation of the effect of unrestricted air bombardment is found in the book The Six Day War.

> To fight in open country for several days on end under constant aerial bombardment and strafing, both night and day, is impossible.[12]

> To have been an Egyptian sitting in a tank in the Sinai desert for 4 days without air cover, at the mercy of the Israeli jets, cannot have been a pleasant experience. Even the bravest and most resolute of armies might have been daunted by the ceaseless bombing and strafing from the air.[13]

The informed military student will quickly point out the lack of air cover, close air support, and adequate air defense of the Arabs which contributed to the lop-sided advantage of highly-skilled Israeli pilots. While this observation is valid, it does offer a "test-tube" example of what an unrestricted and sophisticated air force can achieve: deny the enemy ground forces mobility and destroy even his heaviest armor. The armored cavalry regiment (ACR) would be no exception.

The Israeli Experience: 1973

The Arabs and their Soviet sponsors proved in October 1973 that the lessons of 1967 were well learned. The result was the highest density and mix of sophisticated and effective air defense weapons yet employed in combat. Between the Egyptians and Syrians, 75 battalions of anti-aircraft missiles alone were employed, more than the total U.S. capability. The total of Arab gun/missile systems was more than 10,000.[14]

The effectiveness of this massed AD weaponry was an unpleasant surprise to the IAF pilots who had successfully dodged SA-2s in 1967 by simply flying low.[15] Waiting for the IAF at the lower altitude in 1973 were the SA-6, a tracked missile system, the SA-7 man-portable missile, and the ZSU-23, a tracked quad-23mm cannon system.[16] Their effectiveness in preventing IAF destruction of the bridges across the Suez is described by a New York Times correspondent as follows:

> To the horror of the Israelis.... Plane after plane went down in flames, literally impaled on the wall of explosives the Egyptians raised to defend their pontoon bridges and the bridgehead.[17]

Although dramatically stated, the results were sobering to the Israelis. Faced with similarly protected Syrians advancing in the Golan Heights, the Israelis determined to fly "... into the teeth of a dense SAM defense to stop the most immediate threat."[18]

The Golan Heights offered none of the vital space to trade for time that was available in the Sinai. If the IAF was to be sacrificed, it would have to be in the Golan. Consequently, 80 of the 115 Israeli planes shot down were lost there.[19] The IAF paid the price necessary to penetrate and neutralize Syrian air defenses, thus enabling the A-4

Skyhawks to destroy Syrian tanks with cannon, rockets, and stand-off missiles such as Hobo, Rockeye, and Maverick.[20] Robert Hotz, writing in Aviation Week & Space Technology, summarizes the Israeli/Arab struggle as follows:

> The Syrian mobile defense system on the Golan Heights protecting a 1000-tank offensive was the best the Russians have to export. It stretched from the ground level to 70,000 ft using the ZSU-23 quad-mounted 23mm cannon and SA-7 Strella at low altitudes through the middle altitudes with the SA-3 and the SA-6 with the familiar SA-2 on top, garnished with a heavy top cover of MIG-21s. Yet the Israeli air force smashed and routed it in a bloody four-day battle leaving the Syrian tanks and armored infantry naked to constant waves of air strikes.[21]

The most important lesson demonstrated by the IAF in this case is that even the densest air defense can be penetrated by a determined enemy. It is for this reason that the commander of the USAF Tactical Air Command, General Dixon, believes that missile/gun air defenses have not ended the era of tactical aircraft.[22]

An equally important lesson is the effectiveness of the four 23mm cannons of the mobile ZSU-23-4 tracked systems. The Israeli A-4s, which were used primarily for close air support,[23] suffered the heaviest losses (55) of IAF aircraft. Of these, the ZSU-23-4 took the heaviest toll as the SA-6s forced them into cannon range.[24] It was this threat of SHORAD weapons that General Dixon cites as "... least vulnerable and most numerous."[25] The necessity for comparable SHORAD protection for the ACR is obvious.

The serious threat posed by Arab air defenses forced a change in IAF tactics. In the Golan Heights, the SA-6 forced the IAF from its standard tactic of high angle/altitude release to a high-G, split S evasive dive to the "deck" where they became prey to the ZSU-23s.[26]

Still faced with continuing pilot losses, the Israelis resorted to low-level contour flying in pairs avoiding Syrian air defenses and hitting enemy tank formations in the flank by surprise.[27] Until the Syrian air defenses were finally neutralized from the air, and the Egyptian air defenses by ground attack, the IAF apparently continued this tactic. As will be seen, there is a striking similarity between this modified Israeli tactic and that employed by the Arabs.

The Arab Low Altitude Threat: 1973

The Israelis were not the only users of modern aerial weaponry--they were also the target of Soviet fighter-bombers flown by Arabs. Although the MIG-21 was reported in a ground attack role, the primary Soviet aircraft used by the Arabs in close air support were the SU-7, SU-20, and older MIG-17.[28] The intensity of Arab air attacks peaked on the first day, October 6, and then became almost nonexistant.

The first day was impressive as 100 Egyptian aircraft struck the Israelis along the Bar-Lev Line and deep into the Sinai.[29] The surprise attack flew under Israeli radar scopes and the Arab rockets and bombs effectively found their targets.[30] Cannon strafing,[31] air to ground rockets and bombs were reported as the ordnance delivered on Israeli targets by the MIG and Sukhoi aircraft.[32] Although ineffective, the Egyptians also employed the Kelt, an air to ground missile delivered by TU-16 bomber.[33] Bombs and rockets were primarily employed to supplement the preferred attack method of cannon strafing. The 37mm cannon of the MIG-17, for example, was reported effective against armored vehicles.[34]

Arab tactics, however, may be of greater importance than their

ordnance. Regardless of their flying proficiency, the Arabs reflected their Soviet training and tactics, thus adding another useful area of study. Arab close air support tactics are best described by the Israeli soldiers who survived air attacks of the first day such as Pincas Oren in the Sinai.

> "They came so quickly I couldn't even see them," recalled Pincas Oren. "They flew low and hit hard. Several targets sustained damage."[35]

That same day, October 6, Sergeant Gary Salomon had a similar experience as he was attacked by the Syrians at a forward military post in the Golan Heights.

> There were twenty planes coming at us. It all happened so fast, we didn't have a chance to properly identify them. They came in low, strafing our forward positions.[36]

Reinforcing the reports of low angle attacks by the Arabs, Rami Kaplan, an Israeli air defenseman, stated:

> "When I saw the first four MIGs (MIG-17) coming, I almost pissed in my pants. They shot a brace of rockets at us from a height of about two hundred meters and the whole world turned black."[37]

All close air support of the Egyptian and Syrian air forces appears to have been low altitude with low angle releases[38] and were in many cases ground controlled in the classic Soviet manner.[39] The fact that the IAF resorted to similar low level tactics when faced with heavy air defense probably reinforces the Soviets in their view.

The 20 aircraft that attacked Sgt Salomon were probably from an entire squadron based at a single airfield in accordance with Soviet doctrine.[40] This massed air attack was most likely a result of Syrian overkill rather than standard Soviet doctrine. The four aircraft that attacked Kaplan were probably more typical of a Soviet doctrine of

attacking with a flight of four upon a single target.

The Helicopter as a Threat: 1973

On the surface, the 1973 Middle East War seems a classic opportunity to evaluate the performance and survivability of the helicopter in a sophisticated combat environment. Unfortunately, definite conclusions are elusive. The Arab and Israeli participants utilized helicopters, but not in tactical air cavalry units such as the air cavalry troop of the ACR. Not surprisingly, conclusions have been mixed, some hastily made. For example, the so called "Stratton Report" of the U.S. House of Representatives stated the following:

> The Israeli Air Force Commander had a very negative attitude towards the helicopter and said it was only useful if it could fly at night below (deleted). He referred to it as a "clutch weapon" and said that in the daytime it "did not have a right to exist."[41]

If true, the U.S. would not have to be concerned about a Soviet helicopter threat and could scrap its own helicopter development program and employment of helicopters in tactical units. The hasty conclusion of the Stratton Report was later contradicted, however. The Israeli Air Force Chief of Staff has since stated that he was quoted out of context. In fact, it is known that the Israelis are seeking to buy the U.S. "Cobra" attack helicopter.[42] The mixed conclusions arrive from the varied results obtained on the battlefield.

Using the initial advantages of tactical surprise, the Arabs enjoyed good success with heliborne assaults. On the first day, Syrian heliborne commandos successfully took the vital observation positions of Mount Herman from the Israelis.[43] It was the Egyptians, however, who counted heavily upon helicopter mounted troops. Egyptian Chief of Staff

Shazli took great pride in his twenty tough commando battalions who were to raid deep behind Israeli positions using Soviet helicopters.[44] The daylight helicopter operations on the first day of the Egyptian attack across the Suez resulted in no loss of the Soviet MI-8 helicopters.[45] The Egyptian heliborne units had clearly demonstrated their ability to penetrate the vast and spottily defended Israeli air space.

Later, however, the Israelis began to take a toll of Arab helicopters although they never completely stopped Egyptian insertions. By 14 October, the Israelis claimed to have destroyed 25 Egyptian and 10 Syrian helicopters.[46] The evidence indicates that the IAF accounted for many of the helicopter kills. As more Israeli ground forces arrived on the battlefield increasing detection capability, and as the IAF became more dominant, Arab heliborne operations became correspondingly less successful.[47]

The only major Israeli heliborne operation occured in the Golan Heights and was very successful. On 21 October, a heliborne Israeli paratroop brigade retook the vital position of Mount Herman while IAF Phantoms overwatched and provided close air support.[48] It was these Phantoms that destroyed four helicopter loads of Syrian commandos attempting to reinforce the beseiged Syrian defenders of Mount Herman.[49] The important lesson of helicopter vulnerability to air attack is of great significance.

From the evidence of the Middle East, it is logical to conclude that helicopters can successfully penetrate the airspace of a sophisticated enemy. Without the advantage of surprise, however, local air superiority during the daytime would seem a requirement as the helicop-

ter is extremely vulnerable to modern fighters. U.S. tactics stressing night operations and the avoidance of known enemy ground air defense weapons appear validated. Since neither side employed the armed or attack helicopter, no direct conclusions can be made. However, the previously mentioned IAF desire to purchase the "Cobra" attack helicopter offers an insight to Israeli conclusions and may well affect U.S. and Soviet thinking.

Conclusions

From the Mideast wars of 1967 and 1973, the following general conclusions concerning the low altitude air threat to the ACR can be summarized as follows:

1. An unrestricted, sophisticated air force, such as that possessed by the Soviets, can seriously degrade ACR mobility on the battlefield.
2. Aerial delivered weapons can destroy even the heaviest armored vehicles possessed by the ACR.
3. The types of Soviet air delivered weapons that can be delivered on the ACR are unguided rockets, conventional bombs, and cannon strafing.
4. The Soviets, based on the Israeli experience, could penetrate the densest of air defenses through determination and proper tactics.
5. The Soviet tactics, based upon observation of the Arabs and Israelis, would be to fly as low as possible with low angle release of ordnance.
6. Heliborne assaults are a viable threat to the ACR, but are highly vulnerable to air attack and air defense systems.
7. Based on the IAF experience, high performance aircraft attacking ground targets are highly vulnerable to SHORAD weapon systems.

THE SOVIET LOW ALTITUDE THREAT

Introduction

The lessons from the Middle East can offer clues relating to the Soviet low altitude threat, but they are obviously not comprehensive. We know that the Arabs had limitations in training and equipment. Additionally, the Soviets, in their training and philosophy of employment, consider another dimension--that of the nuclear battlefield.

Since 1965, Soviet military writers have embarked on a directed effort to educate their military professional community to the changes in tactics required by the potential or actual use of tactical nuclear weapons. One of the most important and authoritative books in this area, The Offensive by Colonel A.A. Sidorenko, has been translated into English and published by the U.S. Air Force. It is believed that The Offensive is the equivalent of a doctoral dissertation, for it was published in 1970, the same year Sidorenko was listed as a Candidate of Military Science (roughly equivalent to a Ph. D). Since COL Sidorenko is presently a Doctor of Military Science and a faculty member of the Frunze Military Academy, the publishing of The Offensive by the Military Publishing House in Moscow, and its "recommended reading" status for Soviet officers, mark its validity as an authoritative source about Soviet military thinking.[50] In his review of The Offensive, Colonel Jess B. Hendricks, Jr., states:

> Because of the direct insights into Soviet offensive doctrine, cast in the context of NATO military capability and thought, presented by this work, I recommend consideration be given to issuing a copy to each NATO commander from battalion on up. Action is already underway to integrate this book as a reference into appropriate Command and General Staff College courses.[51]

The Offensive then becomes a primary source to be used, along with Mideast lessons and an analysis of current Soviet tactical aircraft,

to further develop the Soviet low altitude threat to the armored cavalry regiment.

Soviet Ground Attack Aircraft

The Soviet tactical air force numbers about 4,500 aircraft ranging from older YAK 28 and MIG-17 aircraft to the variable-geometry wing MIG-23. Of these, the 500 SU-7, 1,350 MIG-21 and 300 MIG-23 aircraft are worthy of special analysis.[52] Table 1 compares these three Soviet aircraft and a U.S. counterpart to provide an important conclusion. From a ground attack standpoint, the U.S. counterparts are far superior in terms of combat radius, maximum range, and maximum bomb load. This means, in effect, that with less range and bomb load, the Soviet strike aircraft can accomplish less and must operate from bases closer to the forward edge of the battle area (FEBA). In spite of these relative limitations, the sheer numbers of Soviet aircraft demand respect and a detailed analysis of each major type.

The Arab air attacks of the 1973 Mideast conflict demonstrated the effectiveness of Soviet conventional bomb, rocket, and cannon weapon systems. Added to this array are aerial delivered nuclear weapons.[53] Although the Arabs did not employ cluster bomb units (CBU), the logical assumption that the Soviets have such ordnance is made in the Test TC 23-44, How to Train in Small Arms for Air Defense, and should be considered.[54] For the purpose of this study, therefore, the ACR may expect conventional and nuclear bombs, rockets, cannon, and CBU when attacked by Soviet tactical aircraft. All Soviet aircraft compared in Table 1 have this capability.

In the category of a specialized ground attack aircraft, the

Table 1

Comparison of US/USSR Close Support Aircraft

Aircraft Characteristics	Ground Attack Fighter		Multi-Purpose Fighter-Bomber		Fighter-Bomber Variable-Geometry Wing	
	A-7D (US) "Corsair II"	SU-7B(USSR) "Fitter-A"	F-4(US) "Phantom"	MIG-21MF(USSR) "Fishbed-J"	F-111 A/E (US)	MIG-23 (USSR) "Flogger"
1. Combat Radius Statute Miles (Operational height and speed with normal bomb load)	620[b]	200-300[a]	900[a]	UNAVAIL	UNAVAIL	600[a]
2. Maximum Range in Statute Miles (Internal fuel only with no bomb load)	3,400[b]	900[b]	2,300[b]	683[b]	3,800[b]	1,800[b]
3. Maximum Bomb Load (lbs)	15,000[b]	4,500[b]	16,000[b]	2,000[b]	25,000[b]	1,800[b]
4. Maximum Speed (Mach No)	0.9[b]	1.7[b]	2.4[b]	2.2[b]	2.2/2.5[b]	2.5[b]

SOURCE NOTE: a. Jane's All the World's Aircraft 1973-74.
b. Table, p. 89, "The Military Balance, 1974/75," Air Force Magazine, December 1974.

SU-7B ("Fitter-A") has attachments for external stores such as rocket packs and, usually, two 750kg and 500kg bombs under each wing. In addition, a 30mm cannon with 70 rounds of ammunition is located in each wing-root leading edge.[55] As seen in Table 1, the SU-7B carries the biggest payload of Soviet strike aircraft, but at the sacrifice of having the least range. General Dixon, as the Commander of the USAF Tactical Air Command, views the "Fitter-A" as the first of a future family of close air support aircraft which will have improved range and fire power.[56] One improved version, for example, is the "Fitter-B" which is a standard SU-7B with partially variable wings.[57] It is probably the "Fitter-B" or the MIG-23 (full variable-geometry wing) which was the "SU-20" alleged to have been employed by the Arabs in the 1973 Mideast war.[58]

The MIG-21MF ("Fishbed-J") falls into the category of multi-purpose fighter-bombers. Carrying less than half the bomb load of the SU-7B, the "Fishbed-J" has four underwing pylons. The inner pylons can accomodate bombs, fuel tanks, or missiles; the outer pylons can mount 2 rocket packs of sixteen 57mm rockets each. An underbelly pack can house a twin-barrel 23mm gun with a 200 round capability.[59] It was probably this version of the MIG-21 that was employed against the Israelis in 1973.

In the last category, little is known about the MIG-23 "Flogger." Like the F-111, it has a variable-geometry wing which will permit the slower speeds necessary for close air support. The "Flogger" may have radar and missile systems similar to the F-4 "Phantom"[60] and may provide a viable night attack capability.

In summary, the Soviets possess a large number of modern aircraft with bomb, rocket, cannon and, possibly, CBU capabilities. The SU-7B family provides the foundation to build specialized ground attack fighters with greater ranges and bomb loads. Together, the SU-7B, MIG-21MF, and MIG-23 aircraft pose a formidable threat to the armored cavalry regiment.

Soviet Air Attack Priorities

The Mideast War of 1973 reflected only Arab and Israeli air attack priorities. It is The Offensive that reveals critical insight into the air attack priorities of the Soviets. The following quotes offer a clear and consistent pattern in priorities for air strikes.

> Modern front aviation .... can launch powerful and accurate strikes with nuclear and conventional ammunition to a great depth under the most varied weather conditions and destroy the means of nuclear attack, personnel and equipment. It can concentrate its efforts quickly on the required direction and dependably destroy reserves, control posts, various and small size targets and objectives in the rear area.[61]

> ... the air support of attacking troops is connected with the involvement of fighter-bomber aviation first of all. The main objectives of its actions are considered to be nuclear missile and firing weapons, tactical reserves, control points, tanks, and motorized infantry of the enemy which are located beyond the range of the artillery.[62]

> By performing an independent search and immediately destroying important objectives which are detected, especially nuclear attack means and reserves, the aviation has enormous influence on continuity and tempos of attack.[63]

> Usually the main air efforts at night are concentrated on destruction of means of nuclear attack, enemy reserves, and centers of resistance located beyond the range of artillery fire.[64]

Based upon the preceding quotes, the Soviet priorities are in the following order.

1. Nuclear capable weapon systems.

2. Reserves.

3. CPs (Command Posts, or as Sidorenko puts it, "Control points").

4. Other combat elements.

An additional point, evident from these quotes, is that Soviet aviation will particularly concentrate on those targets beyond artillery range.

Concerning the first priority, the attack of our nuclear capable weapons is an almost obsessive theme of Sidorenko. The following clearly states the first priority of air attack.

> ... aviation can accomplish a wide span of missions. The most important of them is the destruction of the enemy's means of nuclear attack. This mission will be accomplished under any conditions.[65]

Sidorenko also considers the destruction of our nuclear capability as the primary mission of Soviet artillery.[66] In fact, in a portion of his Chapter IV, entitled "The Destruction of Tactical Means of Nuclear Attack," he carefully notes that every 155mm howitzer of the U.S. is nuclear-capable, not to mention the 8" (203.2mm) howitzer and our tactical, nuclear-capable missile family. Sidorenko reflects his concern stating, "It is completely obvious that the successful conduct of the offensive is unthinkable without the timely and dependable neutralization and destruction of these means."[67] It is unlikely that the Soviets would alter their first priority if hostilities began in a non-nuclear, conventional situation, for they acknowledge the potential capability of our weapon systems and desire to preempt our use of tactical nuclear weapons by destroying our delivery means.[68]

Concerning the nuclear capability of the ACR, Sidorenko says the following about U.S. capabilities.

It was substantiated in the U.S. press, for example, that now

> the first echelon should consist of small podrazdeleniya (battalion-size units), since these podrazdeleniya, with necessary means for reconnoitering targets or using the corresponding means of superior chasti (regimental/brigade size units) could be given the very same nuclear support as is organized for large chasti and soyedineniya (corps/division size units).[69]

As described by Sidorenko, the battalion-size reconnaissance unit with division type nuclear support may be a reference to the ACR's armored cavalry squadron which has an organic, nuclear-capable 155mm SP howitzer battery.

Although not as an emotional subject as our nuclear capability, Sidorenko also devotes much of his discussion to the second Soviet priority--our reserves. His premise is simple and direct--"Aviation delivers strikes against the enemy's reserves so as to hinder or preclude their maneuver from the very beginning."[70] As will be discussed later, the tank companies of each of the armored cavalry squadrons constitute the normal reserve of the ACR commander.

The third Soviet priority as stated by Sidorenko involves the attack of the vital command and control means of our CPs. This is an important consideration in assessing our own air defense priorities.

The fourth priority still involves combat elements, perhaps because Sidorenko emphasizes sustaining the tempo of attack. It is interesting that Sidorenko seems to down play logistics installations as such. However, it would be foolish to believe that his omission implies that our logistics installations are a low priority.

Restated in terms of the armored cavalry regiment, Soviet air attack priorities are as follow:

1. Howitzer batteries (as nuclear capable units).
2. Tank companies (as reserves).

3. Regimental and squadron CPs.

4. Armored cavalry troops (as other combat elements).

Soviet Ground Attack Tactics

The previously discussed tendency of Soviet tactical air to concentrate on targets beyond their artillery range underlines how artillery and air will complement each other as means of fire support employed against us. In The Offensive, Sidorenko concentrates on the ability of Soviet tactical aviation to use independent "search and destruction" of nuclear delivery systems using the "hunting" method.[71] This method is also used for locating and attacking reserves,[72] and "other important mobile and small-sized targets."[73] The reduction of visual signatures of the ACR must therefore be an important part of its passive air defense to reduce detection. Obviously, an adequate air defense is required to make Soviet reconnaissance and attack of targets of opportunity a costly venture.

Sidorenko makes the claim that modern navigational aids and bombing techniques enable Soviet aviation to accomplish at night "almost all the same missions as it performs in the daytime."[74] He later deals with the use of air-dropped and artillery flares, as well as searchlights, to illuminate the battlefield for tactical aircraft.[75] In this case, we may doubt how well the Soviets can accomplish illuminated air attacks, but not their serious intent. For example, the use of artillery illumination for air strikes is entirely possible. In February 1974, during FTX Brave Rifles VII at Ft Bliss, the howitzer battery of 2/3 ACR fired actual illumination missions over the opposing 3/3 ACR. Two F-4s based at Hollomon AFB, N.M., successfully flew several air strikes

against the surprised 3d Squadron troopers. (The surprise was genuine as no actual fire missions had previously been conducted within the maneuver area itself.) The flares caused exposed windshields and observation devices to stand out, thus facilitating target detection for the pilots.[76] The Soviets may well have experienced similar success.

Whether the Soviet aircraft are "hunting" or on a controlled air strike, the tactics they employ are important to the defender. Sidorenko notes that the increased effectiveness of modern aircraft allows a smaller number of aircraft to accomplish many missions. He supports his view by noting that some foreign nations employ their strike aircraft "singly, in pairs, or in flights." Sidorenko further notes the use of low altitudes and great speeds to counter air defenses, yet permit the destruction of targets.[77]

The previously discussed tactics of Soviet-trained Arab pilots support the high speed, low altitude attack assumed in Army Test TC 23-44, How to Train in Small Arms for Air Defense. The threat assumed in this publication appears supported by both the Mideast experience and The Offensive and is summarized as follows: THE TYPICAL ATTACK WILL CONSIST OF A FLIGHT OF FOUR AIRCRAFT ARMED WITH ROCKETS, 1,100 POUND BOMBS, CLUSTER BOMB UNITS (CBU), AND 23mm/37mm GUNS. FLYING AT LOW ALTITUDE AND HIGH SPEED OUT OF RESPECT FOR OUR AIR DEFENSES, THEY WILL BE IN TWO ELEMENTS OF TWO AIRCRAFT EACH. UPON SIGHTING A TARGET, THE FIRST ELEMENT WILL "POPUP" TO DIVERT ATTENTION FROM THE SECOND ELEMENT WHICH WILL ATTACK WITH A LEVEL, HIGH-SPEED, LOW ALTITUDE PASS OF CBU TO SUPPRESS AIR DEFENSE. USING HIGH SPEED, HIGH-G MANEUVERS, THE FIRST ELEMENT WILL RETURN WITH HEAVIER ROCKET, BOMB AND CANNON ORDNANCE. THE SECOND ELEMENT MAY ALSO RETURN FOR A SECOND PASS IF NECESSARY FOR TARGET

DESTRUCTION AND THE SITUATION PERMITS.[78]

The Tactical Role of the Helicopter

Arab use of Soviet helicopters such as the MI-8, capable of carrying 24 troops (equivalent to the U.S. CH-47),[79] has already been described in the discussion of the Mideast War of 1973. Regarding the success of heliborne operations in the Mideast, the Soviets will obviously draw their own conclusions. Currently possessing 2,500 helicopters of all types,[80] it is obvious that the Soviets see great advantages to "airborne" forces which, according to The Offensive, can be either parachute or helicopter landed. As seen by Sidorenko, troops of the 7 airborne divisions[81] and heliborne forces would have the following missions.

> Appearing suddenly in the enemy's rear, airborne landing forces can disrupt troop control, destroy means of mass destruction, capture and hold important objectives or sectors, distract enemy reserves from their immediate purpose, and thus create favorable conditions to achieve higher tempos of attack....[82]

The Offensive offers a good example of how heliborne forces would be employed with the mission of capturing important objectives. Sidorenko praises a heliborne operation that occurred during the Dnepr exercises in late September 1967. Without prior training, a motorized rifle battalion with its organic weapons and equipment (less vehicles, presumably) was loaded into helicopters to seize a deep objective from the "enemy" forces. The successful accomplishment of their mission facilitated the river crossing by the main body.[83] Two important points of Soviet heliborne employment emerge. The first is the fact that previously untrained Soviet infantry are employed as heliborne troops--all Soviet infantrymen must be considered potential heliborne troops!

The second point is that imagination and experimentation in training are not foreign to the Soviets.

The Mideast lesson of the vulnerability of the helicopter to air attack during daylight operations should reinforce the Soviet doctrine of night attack expressed by Sidorenko in 1970. Although he acknowledges the difficulty of night heliborne (airborne) operations, Sidorenko believes that the night favors their employment.

> Darkness increases the probability of achieving surprise in landing a force and weakens the effect of fighter aviation, anti-aircraft weapons, and the fire of enemy ground troops. All this decreases the vulnerability of the landing forces to enemy attack, hinders the fight against the forces, and as a result, increases the effectiveness of employing tactical airborne landings at night.[84]

Sidorenko's awareness of the advantage of night heliborne operations and his positive tone in discussing other types of night operations offer convincing evidence that the night is a favored period of combat for the Soviets.

We can be more certain of Soviet use of troop-carrying helicopters than their employment of an armed or attack helicopter. Sidorenko devotes several pages of The Offensive to a professional, objective analysis of NATO (primarily U.S.) employment of the armed helicopter noting both their vulnerabilities and their advantages.[85] It is unclear whether he is merely informing his readers of NATO intent, or building a case in 1970 for a Soviet counterpart. It is significant that the Soviets now have a counterpart to the U.S. Cobra--the MI-24. The "Hind A" is the antitank version of the MI-24 armed with Sagger antitank missiles; the "Hind B" is the rocket pod version. Both have a chin turret with an automatic weapon, believed to be a 23mm cannon, and can carry between 8 to 12 troops in addition to their fully loaded

weapon systems.[86] Sidorenko gives us no clues concerning the tactical employment of Soviet armed helicopters. It is logical to assume, however, that they might envision them as armed escorts to provide accompanying fire support for heliborne assaults. At the present, it is too speculative to assume a Soviet concept of armed helicopters employed independently in specially organized units such as our own air cavalry combat brigade (ACCB).

In summary, the Soviet "airborne" threat includes vertical envelopment by parachute forces or normal infantry mounted in troop helicopters, possibly accompanied by armed helicopters. Additionally, there is a high probability of night operations.

SUMMARY OF THE LOW ALTITUDE THREAT

The Soviet low altitude threat to the armored cavalry regiment can be summarized as follows:

High Performance Aircraft

In large numbers, the SU-7B, augmented by the MIG-23, will be the most likely aircraft to attack ACR targets.

Ordnance

Although nuclear capable, conventional bombs, rockets, cannon and CBU are the likely ordnance carried by Soviet aircraft.

Priorities

The Soviets will most likely attack in order of priority:

1. Howitzer batteries.
2. Tank companies.
3. Command posts.
4. Cavalry troops.

Tactics

Flying at low altitude, a flight of four Soviet aircraft will be the most likely formation to attack a single target. Operating in elements of two aircraft each, the first element may "popup" to divert defenders from the second element which will attack using low level/low angle of release tactics. Multiple passes are possible. Illuminated night air attacks can be expected.

Helicopter Employment

The ACR must consider vertical envelopment by heliborne infantry, possibly escorted by armed helicopters. Night heliborne attacks are highly probable.

Potential Effectiveness

Unrestricted, the Soviet tactical air force can deny the ACR mobility on the battlefield, destroy its heaviest armor, and thereby degrade mission accomplishment. Even the heaviest air defenses will not preclude some damage by determined attacks over a sustained period.

Vulnerabilities

Soviet close air support aircraft and helicopters are highly vulnerable to integrated LOMAD/SHORAD/SAFAD systems along the FEBA. High loss rates from these systems would benefit the ACR in that:

1. Air defense units may become an attack priority second only to the nuclear capable howitzer batteries, thus taking pressure off the combat elements.

2. Soviet bombing accuracy would most likely be degraded if Soviet pilots have to adjust tactics out of respect for an effective air defense.

3. Reconnaissance and attack of targets of opportunity ("hunting" technique) would be severely curtailed.

4. The armored cavalry regiment would have a greater assurance of mission accomplishment.

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[34]RB 100-2, op. cit., p. 1-62.

[35]Sherman, op. cit., p. 26.

[36]Sherman., p. 27.

[37]Ibid., p. 33.

[38]RB 100-2, op. cit., p. 1-61.

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[44]Barry, op. cit., p. 86.

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[50]A.A. Sidorenko, The Offensive (A Soviet View), trans. U.S. Air Force (Washington: Government Printing Office, 1974), pp. v-viii.

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[60]Ibid.

[61]Sidorenko, loc. cit.

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[66]Ibid., p. 136.

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[68]Ibid., p. 134.

[69]Ibid., p. 97.

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[74]Ibid., p. 202.

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[76]Headquarters, 3d Armored Cavalry Regiment, After Action Report FTX Brave Rifles VII, 18-25 February 1974 (Ft Bliss: [n.d.]), p. B-13.

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CHAPTER III: THE ACR AS A TARGET AND ITS ORGANIC MEANS OF AIR DEFENSE

INTRODUCTION

TRADOC Bulletin No 2, "Air Defense of the Field Force," states as one of its conclusions:

> U.S. Forces can no longer depend on operating in a total air superiority environment. The Soviets can and will achieve local air superiority and use close air support against our maneuver forces.[1]

With this realistic conclusion and the low altitude threat developed in Chapter II in mind, the armored cavalry regiment (ACR) will be analyzed in this chapter as a target. Its vulnerabilities as well as its defenses must be scrutinized before any determination of a SHORAD shortfall can be made.

Air Defense Doctrine in Armor Publications

Before analyzing the ACR as a target, a brief look at currently published doctrine provides an insight into why armor commanders generally do not understand air defense artillery (ADA) capabilities and limitations, why they tend to do a poor job in assessing themselves as targets, and why they usually provide inadequate guidance to their air defense commanders, both Redeye and Chaparral/Vulcan (C/V).

The existing published doctrine is generally scanty, out-dated, and often erroneous. The basic armor "bible" is FM 17-1, Armor Operations. Published in 1966, the FM's outdated discussion was written before the advent of the present C/V battalion found organic to the division and

corps. Change 1 to FM 17-1, published in August 1969, adds a section on "Army Air Defense Support" which was current at the time, but is now outdated. Specific deficiencies of FM 17-1 with Change 1 are as follow:

1. No discussion is included of C/V or Redeye system capabilities and limitations. Only generalities of dubious value are included.
2. No discussion of how to determine air defense priorities is included, a deficiency common to all 17-series manuals.
3. The missions and employment of AD systems are incorrect. Chaparral is termed an "area defense" weapon to provide coverage of an entire division area. Vulcan is considered a "vital area" defense weapon for large CPs, logistics installations, etc. Finally, Redeye is deemed capable of defending small units as large as a battalion although, according to FM 17-1, it is not integrated into the overall air defense plan of the division of higher unit. Chaparral/Vulcan is never mentioned as low as battalion level!
4. Virtually no discussion is offered concerning the air threat.

With the inadequacy of FM 17-1 evident, deficiencies of other pertinent 17-series manuals are as follow:

FM 17-15--Tank Units, Platoon, Company and Battalion (March 1966). The reader is instructed to refer to FM 17-1 for rules of engagement and a "detailed" discussion of air defnese.

FM 17-36--Armored Cavalry Platoon, Troop, and Divisional Armored Cavalry Squadron (June 1973). A recently updated manual, Annex E provides an excellent Air Defense SOP for non-air defense weapon and Redeye employment, but fails to address determination of priorities, C/V capabilities, limitations, and employment, etc. It also refers back to FM 17-1 for further information.

FM 17-37--Air Cavalry Squadron (June 1969) refers the reader to FM 17-1. FM 17-95--The Armored Cavalry Regiment (May 1966) with Change 1 (March 1970). The basic FM 17-95 of 1966 contains virtually no discussion of air defense! Change 1 (dated 1970) adds Section IX, "Air Defense," which is a general, vague discussion of air defense that deteriorates to the following: "For techniques of fire, rules of engagement, and control of Redeye and non-air defense weapons, see FM 17-1."[2]

It is small wonder that cavalrymen and air defense artillerymen alike at Ft Bliss had difficulties finding a point of departure for integrated 3d ACR/11th AD Gp tactical exercises (as noted in Chapter I). Unfortunately, this malady is pervasive throughout the armor community and must be rectified by publishing updated, comprehensive manuals.

Doctrine in Air Defense Publications

The impact of the 1973 Mideast War is still being felt as a hard look is being taken at U.S. air defense capabilities and the application of lessons learned. Consequently, the air defense "bible," FM 44-1 (February 1970), is also outdated. A draft FM 44-1, to be published in final version upon approval, includes the latest air defense doctrine as it continues to evolve. In the meantime, publications such as Air Defense Trends, the Air Defense Bulletin, and pamphlets such as Army Air Defense, an Overview for the Field Commander, incorporate the updated doctrine to permit its immediate application in the field. Some of the current air defense writing has appeared in Armor magazine such as LTC Staudemaier's pertinent and educational article "Air Defense for Armored Leaders."[3] These excellent publications constitute a concerted and obviously justified effort to bring combined

arms commanders to a doctrinally updated, sound awareness of air defense considerations. Such publications will provide the doctrinal basis for this analysis of the ACR's SHORAD requirements.

The ACR Commander and His Critical Assets

The what to be defended must first be clarified. In the definition provided in Chapter I of a "vital area," it was noted that the term could include a small unit such as a troop, company, or battery. It can also include a command post (CP), logistical area such as combat or field trains, a refueling point, or a key bridge. To avoid confusing a "vital area" with an area defense, the more current term of "critical asset" will be used from this point on. It is essential to understand that the size of a critical asset is relatively small. No SHORAD weapon system can protect an operational area such as a squadron of regimental zone of action, much less that of a division as currently stated in FM 17-1!

The determination of whether an asset is "critical" or "vital" and its priority for protection is the field commander's decision. To make an intelligent decision, the field commander must understand how air defense artillery (ADA) will organize to fight the air battle. Since the air battle involves the principles of weapon mass, complementary weapon mix, mobility, and integration, the ACR commander should understand these principles, as outlined in the pamphlet Army Air Defense, An Overview for the Field Commander. They are:

> MASS is acheived by concentrating ADA weapons on and around a defended critical asset. Normally, no less than a short-range gun/missile battery organization is used in defense of each critical asset. Long-and medium-range, radar-directed systems normally employ an entire battalion organization to defend critical assets.

MIX is achieved by employing a complementary family of weapons. The capabilities of one system offset the limitations of another system to prevent the air threat from defeating (in detail) any particular weapon system. Mix is attained by employing a short-range gun/missile combination to defend critical assets. The long- and medium-range, radar-directed systems complement short-range systems by denying the medium- and high-altitude attack approaches to the air threat.

MOBILITY. Short-range gun/missile units have the mobility to keep up with and maintain the AD coverage for the maneuver force. Medium-range, radar-directed units have and must use mobility to move subordinate firing elements frequently in order to maintain coverage over and beyond the maneuver force and to survive AD suppression attacks.

INTEGRATION is achieved by having short-range AD weapons integrated forward into the commander's scheme of maneuver and integrated rearward, through command and control ties, with all available supporting AD forces.[4]

The key element of the weapon mix is the Hawk missile system which provides all corps units, including the armored cavalry regiment, continuous protection against low and medium altitude air attack. Within the corps area defense "umbrella" provided by Hawk, corps C/V units may be assigned to protect a nondivisional unit such as the armored cavalry regiment.[5]

Although to achieve sufficient mass, a complete C/V battery is preferable to defend a designated critical asset, a platoon of four systems is the smallest unit which can adequately protect an asset. Recognizing the scarcity of ADA assets, the Cavalry/Scout Study notes that a platoon of four Vulcan systems provides adequate mass for an attacking company.[6] At Fort Knox on 2 October 1974, a Vulcan platoon and a Redeye team were demonstrated for the TRADOC/FORSCOM Commanders' Conference to show how they provide the minimum air defense necessary for a company-size maneuver team.[7]

An extension of this doctrine applies to Redeye. To insure

overlapping coverage, the entire Redeye section is required to adequately protect a critical asset.[8] This consideration is logical since all Redeye sections have at least four teams which roughly equate to the four systems of the Vulcan or Chaparral platoon required to protect a single critical asset.

In summary, the ACR commander must consider at least a C/V platoon or Redeye section to achieve sufficient mass to effectively protect a critical asset. His designated critical assets for air defense protection must be no larger than troop/company/battery-size units, command posts, or trains.

THE ARMORED CAVALRY REGIMENT

Organization and Missions

As shown in Figure 1, the ACR consists of a Headquarters and Headquarters Troop, Air Cavalry Troop, and three Armored Cavalry Squadrons. Normally assigned as a corps non-divisional unit, the ACR has the following mission and capabilities.

MISSION: To provide security and perform reconnaissance for the unit to which assigned or attached and to engage in offensive, defensive, or delaying action as an economy of force unit.

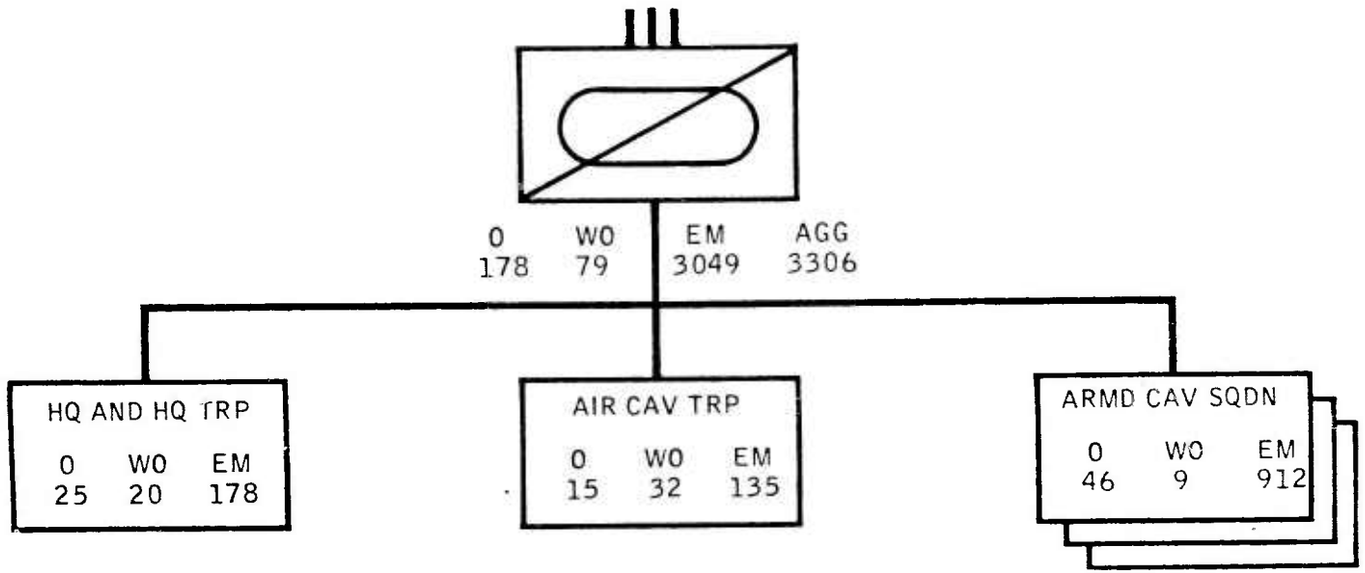
CAPABILITIES:
a. Conducts reconnaissance operations.
b. Conducts security operations.
c. Operates in an economy of force role without being reinforced in offensive, defensive, or retrograde operations.
d. Operates as a task force when suitably reinforced in offensive, defensive, or retrograde operations.
e. Operates in support of forces engaged in stability operations.[9]

The regimental Headquarters and Headquarters Troop (HHT), as shown in Figure 2, provides the command, control and supervision means of the regimental headquarters.[10] As such, HHT assets will normally be

Figure 1

Organization of the Armored Cavalry Regiment

MISSION. To provide security and perform reconnaissance for the unit to which assigned or attached and to engage in offensive, defensive, or delaying action as an economy of force unit.
ASSIGNMENT. To field army and corps.
CAPABILITIES. a. Conducts reconnaissance operations.
b. Conducts security operations.
c. Operates in an economy of force role without being reinforced in offensive, defensive, or retrograde operations.
d. Operates as a task force when suitably reinforced in offensive, defensive, or retrograde operations.
e. Operates in support of forces engaged in stability operations.



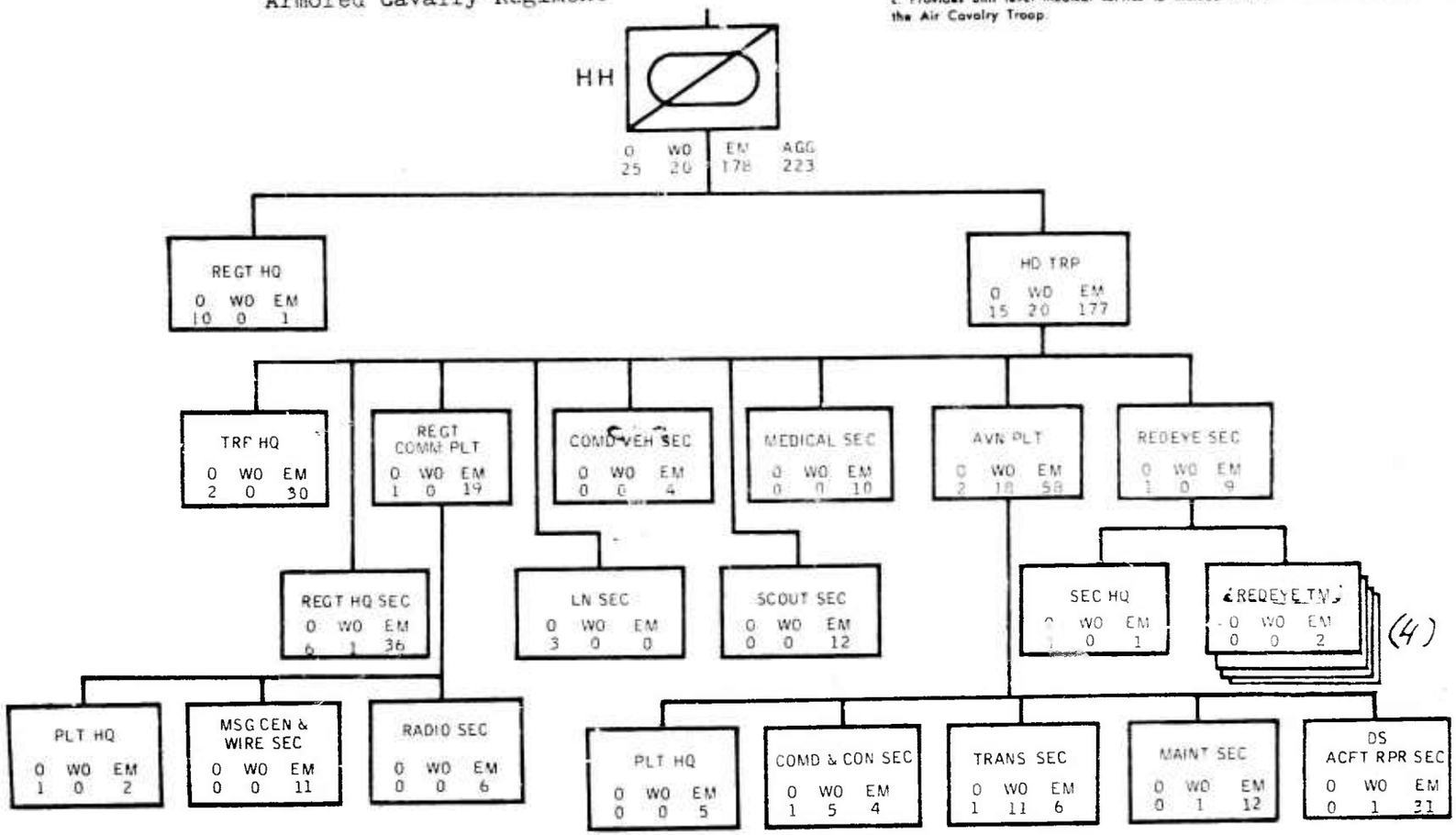
Note. One Military intelligence Detachment, TOE 30-14, will normally be attached to the regiment.

Source: U.S. Army Armor School, ST 17-1-1, Armor Reference Data (Ft knox: January 1974).

Figure 2

Organization of the Headquarters & Headquarters Troop, Armored Cavalry Regiment

MISSION. Provides command, control, and supervision for the armored cavalry regiment.
ASSIGNMENT. Organic to Armored Cavalry Regiment, TOE 17-51.
CAPABILITIES. a. Commands, controls, performs staff planning, and furnishes communication and supervision of operations.
b. Provides air vehicles for command and control, liaison, and air movement of troops, supplies, and equipment.
c. Provides unit level medical service to include medical care and evacuation to the Air Cavalry Troop.



Note. Under augmentation, 1 Provost Marshal section authorized in Regt HQ Sec; 1 Military Police platoon authorized.

Source: U.S. Army Armor School, ST 17-1-1, Armor Reference Data (Ft Knox: January 1974).

divided between the regimental command post (CP), HHT Aviation Platoon assembly area, and regimental field trains. The HHT Aviation Platoon assembly area provides the base for its 10 helicopters, the DS Aircraft Systems Repair Section which supports all 49 regimental aircraft, and the 12 helicopters organic to the squadrons. The resulting 22+ helicopters and their ground support assets dictate that the platoon establish its own assembly area to avoid further congestion of the regimental field trains. As the largest single critical asset of the regiment in size, the regimental field trains can number over 200 vehicles.[11] This number includes the bulk of squadron logistical assets, and attached corps logistical assets such as a DS maintenance company, medical company, transportation company, etc.

The Air Cavalry Troop (ACT), as a tactical unit of 27 helicopters (Figure 3), may operate from both its rear assembly area and one or more FARRP (Forward Area Refueling-Rearming Point) locations.

The Armored Cavalry Squadron (Figure 4) merits special attention. Designed as a combined arms force, the squadron has the same basic mission and capabilities as the regiment. With its own HHT for command and control, the squadron commander employs three Armored Cavalry Troops, a Tank Company, and an organic SP, 155mm Howitzer Battery (found only in the squadron of the ACR).

The squadron HHT (Figure 5) will normally be divided between the squadron CP, a combat trains, and the regimental field trains.

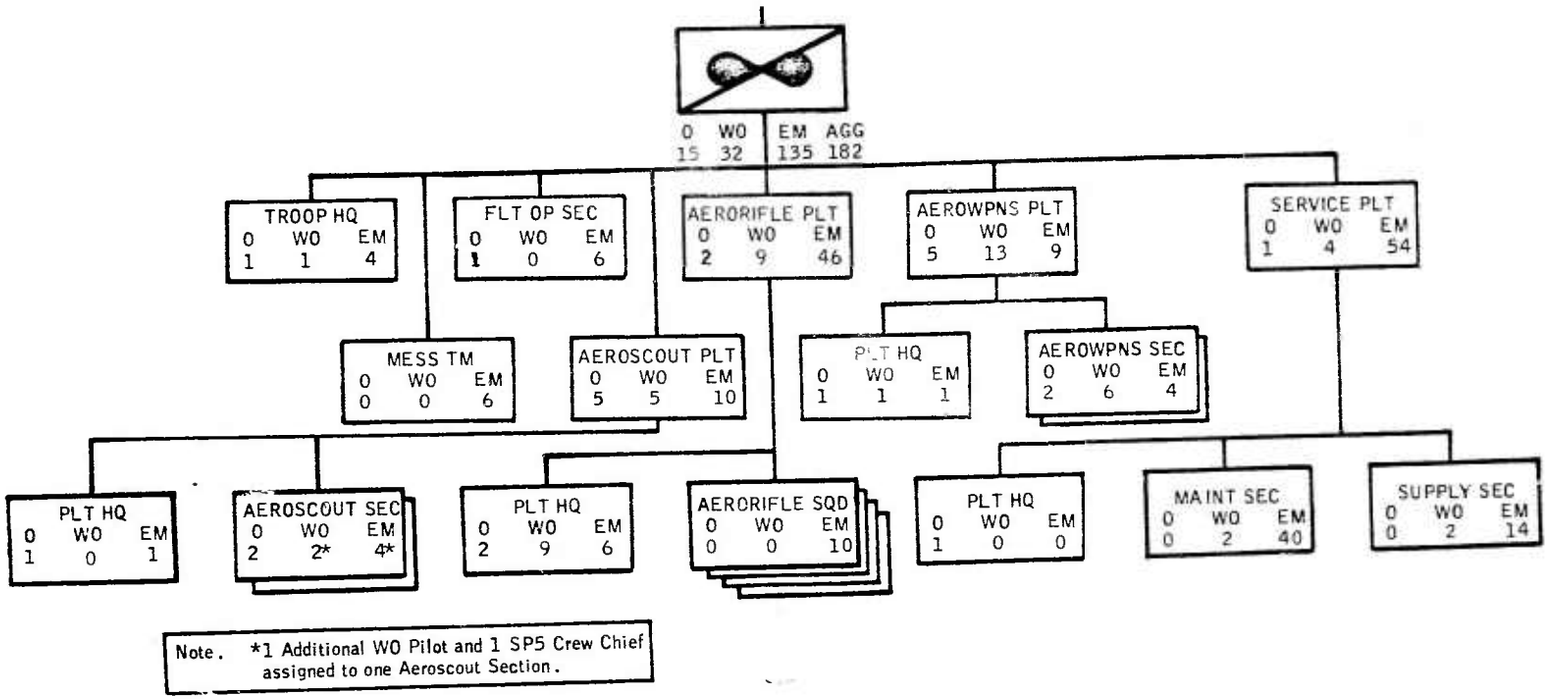
The Armored Cavalry Troops (Figure 6) are normally fully deployed across wide frontages, particularly when performing reconnaissance or security missions.

Consisting of 17 M60A1 medium tanks, the Tank Company of the

Figure 3

Organization of the Air Cavalry Troop, ACR

MISSION. To extend by aerial means the reconnaissance and security capabilities of ground units. To engage in offensive, defensive, or delaying actions within its capability and to seize and dominate lightly defended areas or terrain features.
ASSIGNMENT. Organic to the Armored Cavalry Regiment, TOE 17-51.
CAPABILITIES. a. Performs air and ground reconnaissance and provides security for unit to which assigned or attached.
b. Engages in offensive, defensive, or delaying actions.
c. Conducts independent action when properly reinforced.

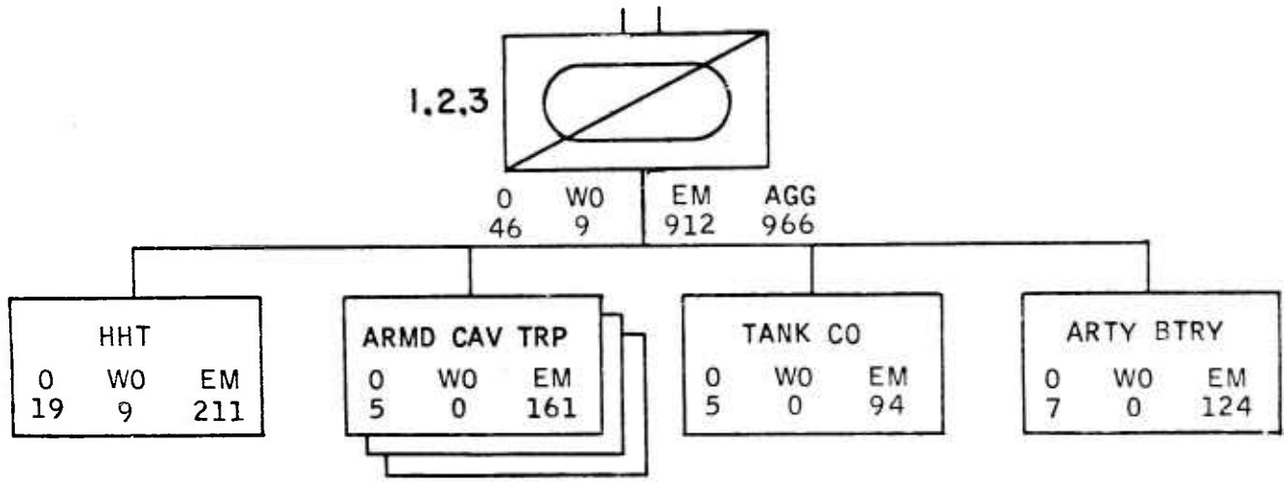


Source: U.S. Army Armor School, ST 17-1-1, Armor Reference Data (Ft Knox: January 1974).

Figure 4

Organization of the Armored Cavalry Squadron, ACR

MISSION. To provide security and perform reconnaissance for the unit to which assigned or attached and to engage in offensive, defensive, or delaying action as an economy of force unit.
ASSIGNMENT. Organic to Armored Cavalry Regiment, TOE 17-51.
CAPABILITIES. a. Provides security and performs reconnaissance for a higher echelon.
b. Executes combat missions suitable for light armored units.
c. Operates as an armored task force when suitably reinforced.

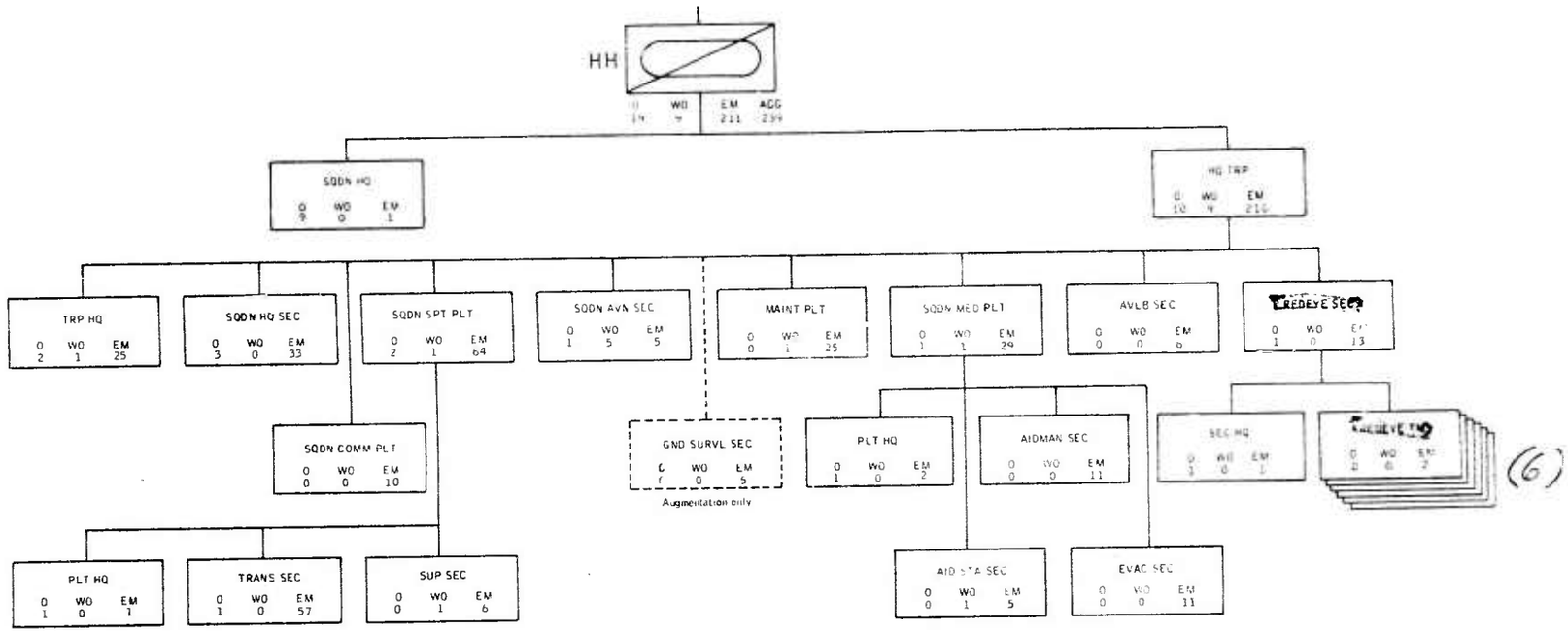


Source: U.S..Army Armor School, ST 17-1-1, Armor Reference Data (Ft Knox: January 1974).

Figure 5

Organization of the Headquarters & Headquarters Troop, Armored Cavalry Squadron, ACR

MISSION. Provides command, control, and supervision of the operations of the Armored Cavalry Squadron and attached units.
ASSIGNMENT. Organic to Armored Cavalry Squadron, Armored Cavalry Regiment, TOE 17-55.
CAPABILITIES. a. Commands, controls, provides staff planning, furnishes communications, and supervises operations.
b. Furnishes supply, transportation, and organizational maintenance for organic and attached units.
c. Provides unit medical service to the cavalry squadron, to include furnishing aidmen to cavalry troops.

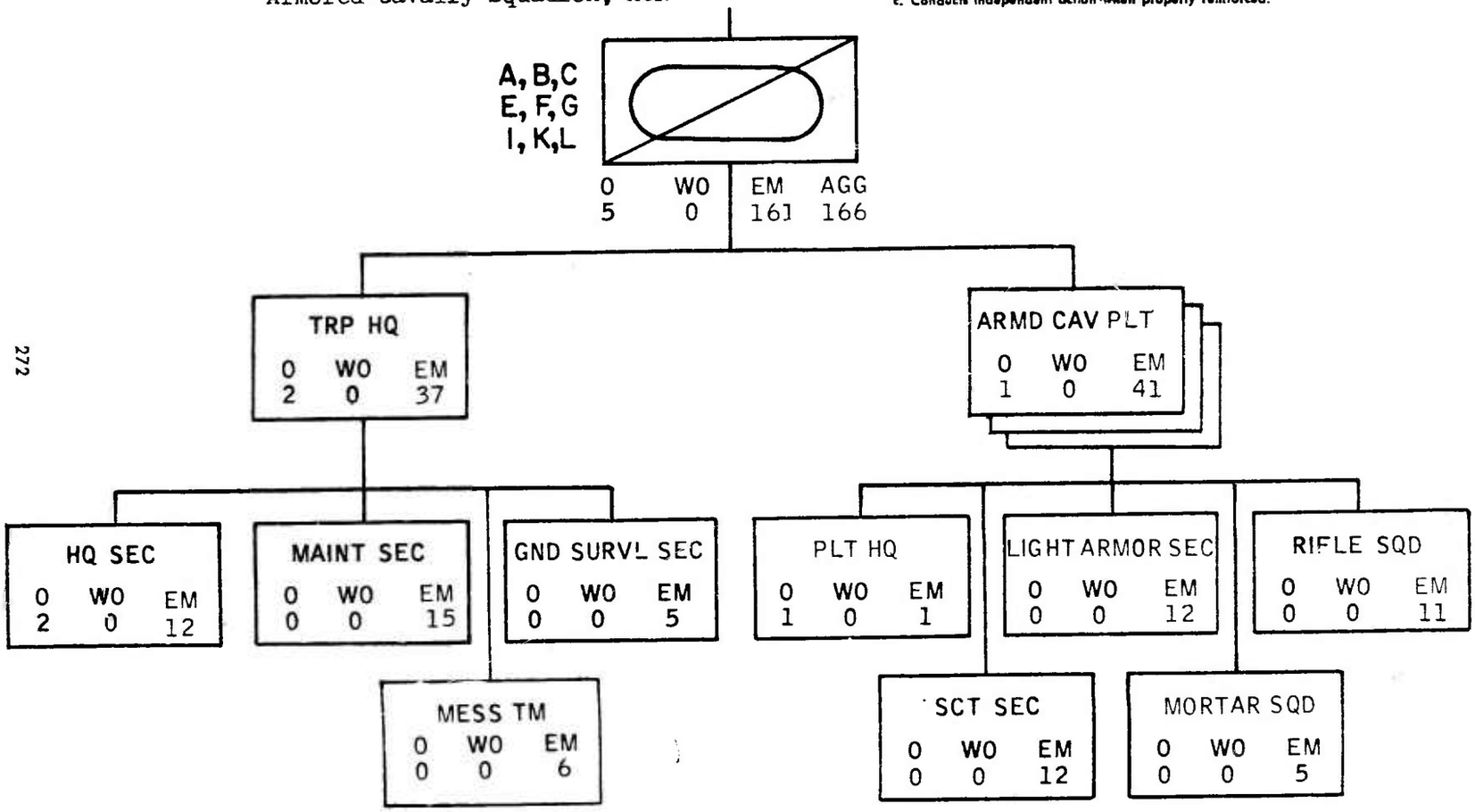


Source: U.S. Army Armor School, ST 17-1-1, Armor Reference Data (Ft Knox: January 1974).

Figure 6

Organization of the Armored Cavalry Troop,
Armored Cavalry Squadron, ACR

MISSION. To provide security and perform reconnaissance for the unit to which assigned or attached, and to engage in offensive, defensive, or delaying action as an economy of force unit.
ASSIGNMENT. Organic to Armored Cavalry Squadron, Armored Cavalry Regiment, TOE 17-55.
CAPABILITIES. a. Performs reconnaissance and provides security for unit to which assigned or attached.
b. Engages in offensive, defensive, or delaying actions.
c. Conducts independent action when properly reinforced.



Source: U.S. Army Armor School, ST 17-1-1, Armor Reference Data (Ft Knox: January 1974).

squadron (Figure 7), is the normal squadron reserve, and is usually deployed as a single unit over much less area than the cavalry troop.

The Howitzer Battery (Figure 8) provides both conventional and nuclear fire support for the squadron, on which it also orients its movement. To provide continuous fire support, the battery often displaces by echelons which can pose significant problems for its air defense.

Common to the regimental and squadron HHTs are Redeye sections which provide an organic SHORAD capability. The regimental section has four teams;[12] each squadron section has six teams[13] for a total of 22 teams in the regiment. With only four Redeye Teams, it takes little analysis to determine that the regimental HHT Redeye section is hard-pressed in protecting the regimental CP, air cavalry troop, aviation platoon, and the huge regimental field trains. With six teams, each squadron at least has the capability of providing one team with each troop, company, and battery.

The ACR as a Target

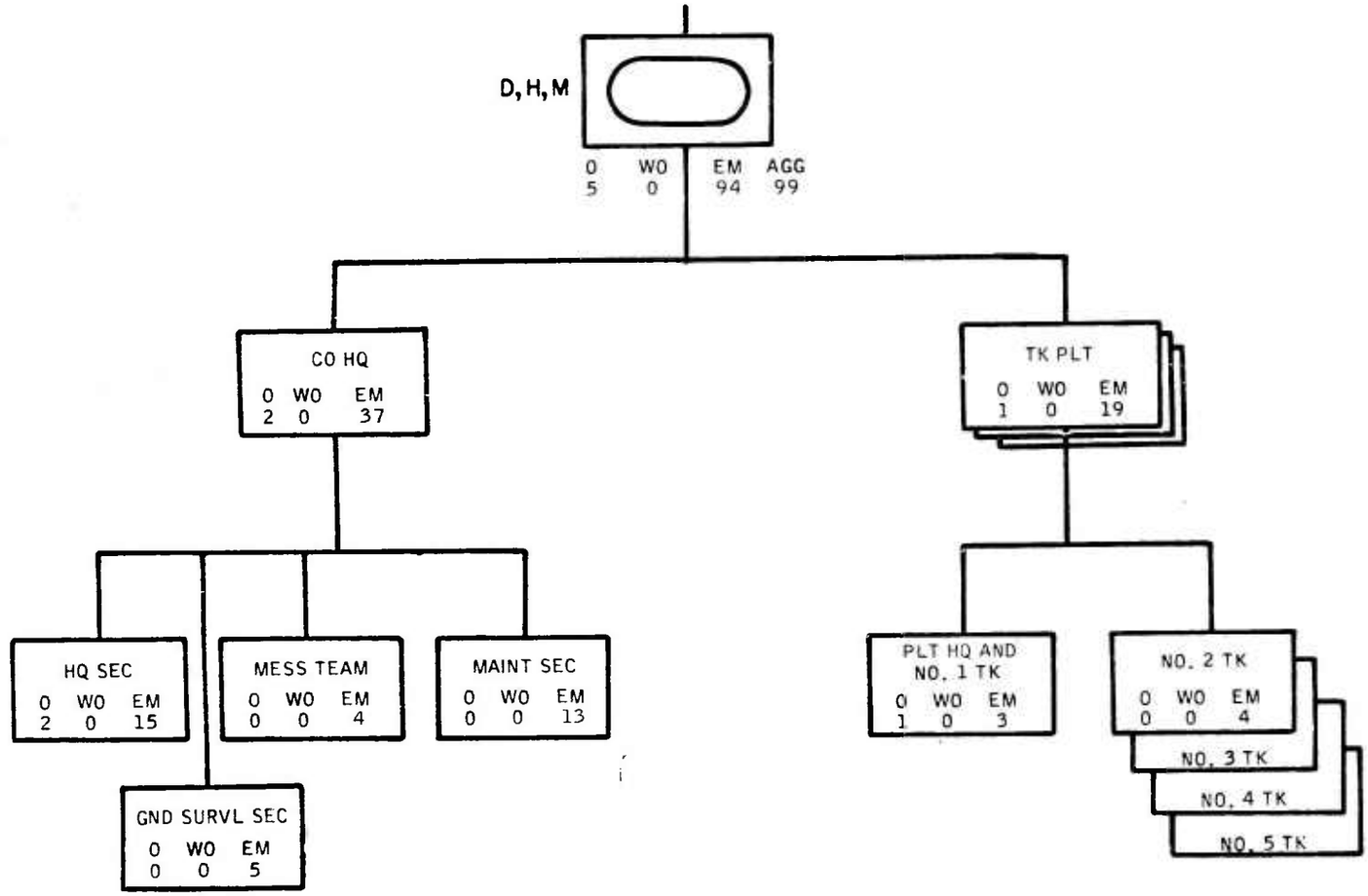
As previously discussed, the ACR commander, in analyzing his critical assets, considers each separate troop, company, battery, CP assembly area and logistical installation as potential targets of Soviet aircraft. A summary of the ACR's critical assets, without discrimination as to size or priority, is as follows:

Level	Critical Asset	Total
Regiment	Command Post	1
	ACT Assembly Area	1
	ACT FARRP (daytime)	1
	HHT Avn Plt Assembly Area	1
	Field Trains (Includes field trains of all subordinate units)	1

Figure 7

Organization of the Tank Company, Armored Cavalry Squadron, Armored Cavalry Regiment

MISSION. To close with and destroy enemy forces using fire, maneuver, and shock effect.
ASSIGNMENT. Organic to Armored Cavalry Squadron, Armored Cavalry Regiment, TOE 17-55.
CAPABILITIES. a. Attacks or counterattacks under hostile fire.
b. Destroys enemy armor by fire.
c. Supports mechanized infantry, infantry, reconnaissance, or other tank units by fire, maneuver, and shock action.
d. Provides the mobility, armor protection, and firepower to successfully exploit the effects of nuclear and nonnuclear fire support.

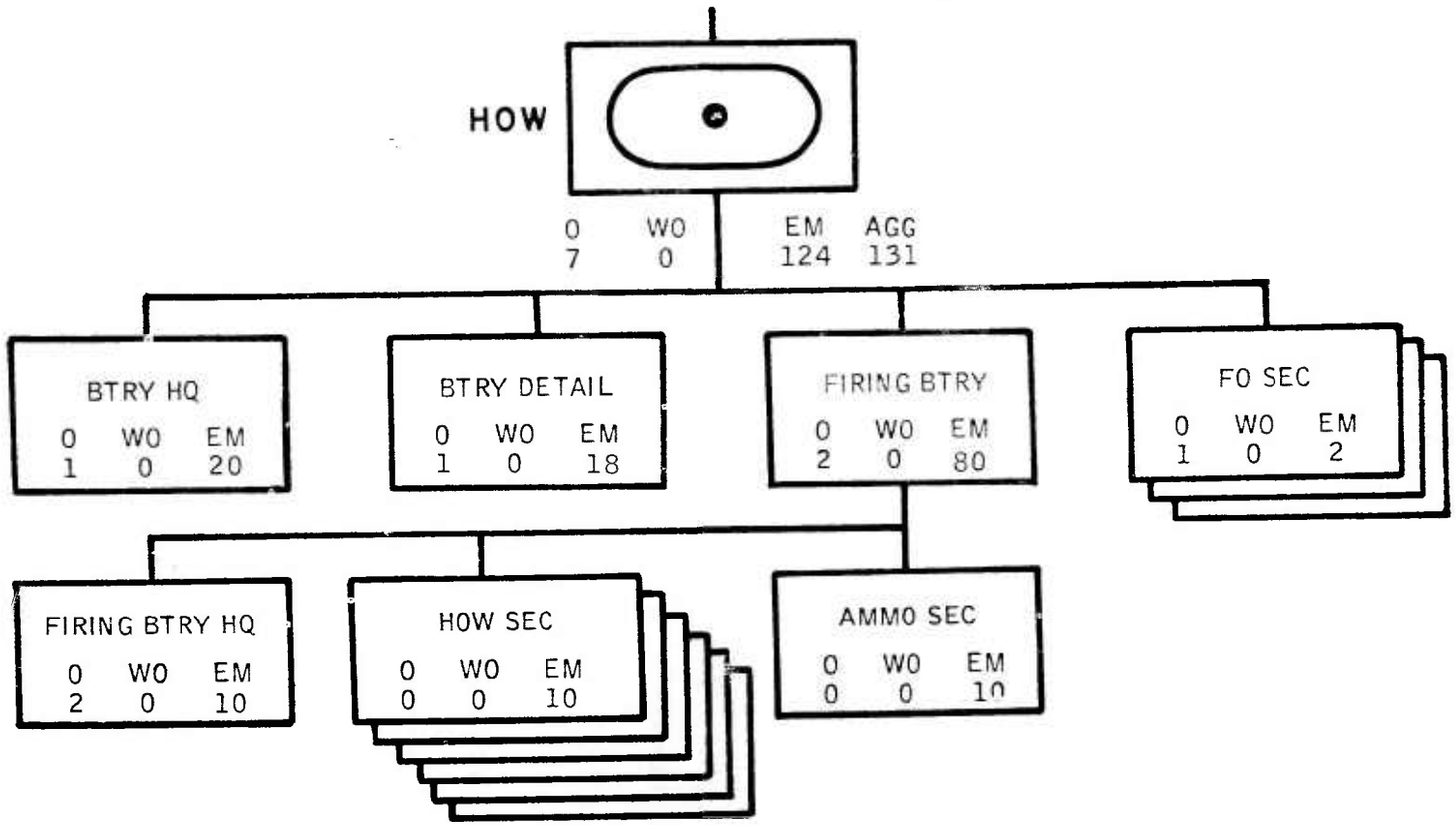


Source: U.S. Army Armor School, ST 17-1-1, Armor Reference Data (Ft Knox: January 1974).

Figure 8

Organization of the Howitzer Battery,
Armored Cavalry Squadron, ACR

MISSION. To provide fire support for the armored cavalry squadron, armored cavalry regiment and to furnish its portion of the target acquisition, communication, and survey systems.
ASSIGNMENT. Organic to the armored cavalry squadron, armored cavalry regiment, TOE 17-55.
CAPABILITIES. a. Artillery fire support, crosscountry mobility, rapid emplacement, and furnishing its portion of the armored cavalry squadron's target acquisition, communication and survey systems.
b. Transportation of 150 rounds per howitzer of the prescribed basic load of artillery ammunition of 275 rounds per howitzer.
c. Additional capability to safeguard nuclear materials will be provided by attachment of the appropriate number of teams for USA FA Security Team—Cannon, TOE 6-500.



Source: U.S. Army Armor School, ST 17-1-1, Armor Reference Data (Ft Knox: January 1974).

Level	Critical Asset	Total
Squadrons (3)	Command Posts	3
	Combat Trains	3
	Armored Cavalry Troops	9
	Tank Companies	3
	Howitzer Batteries	3
	TOTAL, ACR	26

At this point, a simplistic approach to determine the additional SHORAD requirement could be made as follows:

26 critical assets - 4 Redeye sections = 22 critical assets/shortfall (or a requirement for 22 C/V platoons)

$$\frac{\text{22 C/V platoons}}{\text{3 platoons/battery}} = 7.33 \text{ batteries}$$

$$\frac{\text{7.33 batteries}}{\text{4 batteries/bn}} = 1.83 \text{ C/V Battalions}$$

The result of 1.83 C/V battalions could easily be rounded up to 2 full battalions with the consideration of a full battery to defend the large regimental field trains. Obviously, no U.S. Army corps commander could afford to protect his ACR with two full C/V battalions even if he had the assets. The U.S. Army is not likely to compete with the Soviets quantitatively in air defense assets. As noted in Chapter II, the Soviet-supplied Egyptian and Syrian forces in the Mideast War of 1973 employed more air defense missile battalions than the entire U.S. Army possesses. Therefore, huge quantities of air defense weapon systems are not the answer for the ACR or any U.S. maneuver unit. Before a realistic assessment of the SHORAD requirement of the ACR can be made, the components of passive and active air defense measures available to the regiment must be analized and employed to the maximum extent possible.

PASSIVE AIR DEFENSE

Introduction

Recent 3d ACR experience in the Ft Bliss desert training areas in Texas and New Mexico have reinforced an old lesson in passive air defense--what the enemy cannot detect from the air, he cannot attack. This was illustrated during the four days of extensive maneuver during JTX Brave Shield VI in October 1973. None of the regimental/squadron command posts or combat and regimental field trains were detected or attacked by either the helicopters of the Air Cavalry Combat Brigade (ACCB) or their supporting high performance aircraft.[14] The effectiveness of the passive air defense measures of camouflage, night displacements, night resupply, and the reduced size of CPs all contributed to the success of the 3d ACR. In an electronic warfare (EW) environment, passive measures will also limit Soviet detection of targets through electronic means and possible attack from the air. Passive air defense, then, is a vitally important component of air defense which merits considerable discussion.

Camouflage

At the present time, the Army has a program to camouflage paint all tactical vehicles and eventually provide light-weight, radar-energy-absorbing camouflage nets for each vehicle and aircraft.[15] Due to development and funding problems, we are far from reaching this goal. At Fort Bliss, the 3d ACR relied heavily on a technique called "mud-painting."[16] Fine dirt was mixed with water and pattern "painted" on the vehicles with brushes or brooms. Although easily removed by rain, the mud-painting technique had the advantage of the texture and color of the

local soils. Expertise was developed in breaking up vehicle outlines with proper contrasting to include gun tubes and track and suspension. Some vegetation was added to further break up outlines. In the 3d ACR, scarce camouflage nets were limited to the more vulnerable command posts.

A testimony of the effectiveness of camouflage is made by 1LT Jchnson, Aeroscout Section Leader of the Air Cavalry Troop, 3d ACR, in his article "Can Aeroscouts Survive Desert Dangers?"

> Areas comprised predominantly of sand dunes are the most difficult in which an aerial observer might attempt to locate hostile armored forces. With proper camouflage a stationary M60A1 emplaced among 15 foot sand dunes escapes detection at a range of 200 meters.[17]

A key word in 1LT Johnson's description is "stationary." Air Force pilots and forward air controllers agree that a moving vehicle is more easily detected. But even a vehicle as large as a tank, if simply stopped next to a sand dune, is usually lost by pilots. This effective combination of camouflage and an immediate halt by a terrain feature, preferably in shadows, resulted in the following guidance to 3d ACR troopers.

> If under attack when moving, stop the track near a sand dune. Pilots have great difficulty distinguishing targets from dunes.[18]

The task of camouflage is considerably easier for CPs and stationary vehicles than for helicopters. Efforts to reduce the glare of windscreens by covering them with OD blankets were unsatisfactory as they tend to scratch the plexiglass or produce static electricity which attracted clinging dust. Improperly used camouflage nets, when available, can damage rotor heads complicating helicopter camouflage.[19] Although no breakthroughs have been achieved on windscreen and rotor signature, the U.S. Army has developed camouflage pattern painting

techniques for the helicopter.[20] The realization that helicopter assembly areas are highly vulnerable to enemy detection from the air should result in aviation assets being located apart from other installations such as CPs and trains.

In summary, effective camouflage, in conjunction with other passive measures, can be considered the primary air defense measure for command posts and small logistical installations. Aviation assembly areas pose the greatest problem in this area.

Dispersion

CPT Robert Kimball, in his article "Artillery in Air Defense," states that "... one air-delivered conventional bomb could eliminate the combat effectiveness of an entire unit."[21] Dispersion can not only reduce the effects of an air attack, but can aid in preventing detection. A "gaggle" of vehicles simply defies proper camouflaging, invites aerial detection, and presents a lucrative target. Dispersion is an obviously effective defense measure that is inherent in some ACR units. An armored cavalry troop operating on a frontage of 5-7 km, with its three ten-vehicle platoons on line, presents an average density of only one vehicle per 167 to 233 meters. It is not likely that an enemy air attack could seriously hamper the troop operating over such large frontages.

Other ACR critical assets lack the inherent dispersion of a deployed troop. For example, the howitzer battery and the tank company (poised for its reserve role) are quite lucrative targets. The 200+ vehicles of the regimental field trains compound their air defense problem because of the large area necessary for their dispersion.

Dispersion is difficult but vital for helicopter assembly areas because of their inherent "softness," difficulty to camouflage, and lack of mobility on the ground.

In summary, the inherent dispersion of the deployed armored cavalry troop could offer this unit its best air defense. Other critical assets, while requiring dispersion, cannot rely on this passive measure alone.

Reduction of Combat Trains

Of all 3d ACR critical assets, the squadron combat trains can vary the most in size. Over several months of analysis, the decision was made in the 3d ACR to concentrate the majority of combat service support in the regimental field trains. Austere combat trains during JTX Brave Shield VI (Oct 73) and FTX Brave Rifles VII (Feb 74) averaged about five vehicles. Located about 5 km from line units, these were vehicles with emergency POL, ammunition, C-rations, water and a DS maintenance contact team. The squadron maintenance collection point was either collocated with the combat trains or in the near vicinity.[22] As combat vehicle failures develop, the maintenance collection point can become undesirably large and vulnerable to detection and attack from the air, thus arguing in favor of a separate location from the combat trains.

With the combat trains reduced to a very few vehicles, the passive air defense measures of camouflage and reduced movement can provide the primary means for their protection.

Night Tactical and Resupply Operations

Regardless of A.A. Sidorenko's belief that Soviet tactical

aviation can accomplish at night almost as much as during the daytime, target acquisition at night is simply more difficult. For this reason, night tactical operations capitalize on the cover of darkness as a passive measure, particularly in the offensive. Night movement to and occupation of assembly areas, passage of lines, and movement to contact can minimize interference by Soviet aviation. During JTX Brave Shield VI, the 3d ACR was precluded by the scenario from initiating offensive operations at night. The regiment would have preferred "laying low" during daylight hours and attacking about 2000 hours with the aim of initiating and fighting as much of the battle as possible under the cover of darkness. As a primarily helicopter-dependent unit, the ACCB would have been hard pressed as noted in the 3d ACR after action report.

> If it were not for the restrictive REDCOM scenario, the Regiment would have driven through the friendly forces in one or two nights. Distance would have been the only effective night defense measure available to the friendly forces.[23]

The 50 km distance to achieve 3d ACR objectives would obviously have been more difficult if opposed by significant ground forces. However, the major lesson learned is that both the helicopter and ground attack aircraft threat can be minimized by night operations.

While night tactical operations may not always be feasible, total reliance upon night resupply has been demonstrated as feasible by the 3d ACR. The large, vulnerable field trains and both the regimental aviation platoon and air cavalry troop assembly areas were positioned 15-20 km behind the line of contact. This distance was intended to place these "soft" installations beyond Soviet medium artillery range.

The night resupply of the 3d ACR evolved into the following procedures. Immediately upon nightfall, three to four separate convoys

would depart the field trains destined for the squadron combat trains and regimental CP. Each convoy carried ammunition, POL, repair parts, repaired radios and DX items, C-rations and, if consistent with the tactical situation, a hot evening meal. Upon reaching the squadron combat trains, troop/company/battery representatives would meet their "slice" of the convoy and take it to the forward positions where resupply would take place. The convoys would reform at the combat trains and return to the regimental field trains to camouflage prior to dawn.

The intent of accomplishing night resupply is to avoid detection and disruption by enemy aviation. The location of the regimental field trains is dependent upon the total hours of darkness available to achieve a complete turn-around. During the short night hours of the summer, the field trains would have to be positioned within Soviet medium artillery range to shorten the time/distance factors. This risk is accepted because the primary consideration remains the avoidance of air attack of convoys and resupply activities by using the hours of darkness.

An obvious conflict exists between routine night resupply and night tactical operations. During FTX Brave Rifles VII, conducted 18-25 February 1974, the 3d ACR twice demonstrated that a complete night resupply can sustain the regiment for a 48 hour period or for two days and one night of tactical operations. Sufficient water, POL, C-rations, and ammunition can be supplied to allow a skip of one night in major resupply. The combat trains may be "beefed up" with additional ammunition and POL vehicles if necessary. Obviously, close coordination is required between the regimental S3 and S4 to achieve adequate resupply. The S4, in addition, may choose to displace the entire field trains

under the cover of darkness on those nights that a major resupply is skipped.

In summary, both tactical and resupply operations can utilize the night to minimize air attack. Night resupply, as a matter of routine procedure, is feasible and preferable.

Passive Defense Measures of Command Posts

One of the key factors in avoiding ACCB detection of CPs during JTX Brave Shield VI was the reduction of the size of regimental and squadron command posts. Over a period of several months, luxuries such as field kitchens, tents, and other logistical support were pared which resulted in the following reduction.

3d ACR Command Post Comparison[24]

Unit CP	Before Reduction			After Reduction		
	Wheels	Tracks	Total	Wheels	Tracks*	Total
Regiment	20	6	26	10**	5	15
1st Squadron	13	5	18	1	4	5
2d Squadron	10	9	19	1	4	5
3d Squadron	19	8	18	1	4	5

* Excludes the 2 tracked vehicles of each command group.
** Number includes vehicles of: USAF Air Liaison Officer; C/V Bn Airspace Control Element (ACE); Army aviation platoon; SIGINT support element/electronic warfare element (SSE/EWE); regimental scout platoon (4 ¼T vehicles deployed as local security)

The squadron command posts consist almost entirely of four M577 command post (tracked) vehicles, one of which is purely communications. They can easily displace cross-country and, once halted, be quickly and easily camouflaged. The larger regimental CP requires more dispersion and poses a more difficult camouflage problem. However, the most vital

functions of the CP center on a "core" of three of the five M557 command post vehicles. The fourth is a purely communications (RATT) track, and the fifth is an alternate or "jump" CP used in displacements. These five M577s provide the same cross-country mobility and ease of camouflage as those of the squadron CPs.

Whenever the tactical situation permits, the regimental and squadron CPs displace at night and by dawn are static and fully camouflaged. In fast moving situations, day displacements are often required which should be cross-country and in a dispersed formation, particularly in the desert to reduce their dust signature. Movements into new positions should be organized and smooth. Track signatures should be erased, and vehicles quickly camouflaged to minimize detection from the air.

One of the most significant problems associated with the command post is the "forest" of antennas known as the "antenna farm." This effect poses both a serious visual and electronic signature which can result in an air attack. Borrowing from a field expedient used by the 1st Cavalry Division at Fort Hood, the 3d ACR began remoting radios and their antennas from the CP vehicles. This technique is possible using the AN/GRA-39 remote unit which can enable the remote operation of the radio up to 1 mile. An obvious disadvantage is that the radio itself must be remoted along with the antenna which requires a power source and an operator to change channels and provide security. In addition, the remote unit itself consumes a large number of BA-30 batteries daily. An obvious requirement exists for a means to remote only the antenna, thus enabling the normal operation of radios from within the CP.

Helicopters can easily compromise the location of a hidden CP by

landing too near and remaining too long on the ground. During JTX Brave Shield VI, the use of helicopters was severely curtailed during daylight hours; consistent with regimental SOP, helicopters were not used for command and control--tracked command groups were used exclusively.[25] The following procedures were followed on occasions which required helicopters to land near a CP: helipads were located at least 1 km from the CP and moved frequently; helicopters discharged occupants, then immediately took off for either a helicopter assembly area or a loiter position within 5 km.[26] In this manner, the passive air defense of the CP was enhanced.

In summary, by reducing their administrative and logistical tail, regimental and squadron CPs can rely on the passive air defense measures of small size, cross-country mobility, night displacements, remoted antennas (reduced visual and electronic signature), reduced helicopter activity, and camouflage as their primary means of protection from air attack.

Reduction of Visual Signatures

Since the ACR cannot always operate at night, visual signatures during the daytime can make the Soviet aviator's job in locating and attacking critical assets much easier. The problems of helicopter windscreen glare, and CP "antenna farms" have already been addressed. Remaining, however, are the persistent problems of dust, smoke and personnel-unique signatures.

Inherent in the problem of dust signature is movement. As previously discussed, aviators can more easily acquire a moving vehicle. A moving vehicle, if carelessly driven, can create a hanging dust plume

visible for miles. Because aviators tend to orient on road features, they can easily acquire dust signature and vehicle movement on roads and installations located immediately off roadways. The 3d ACR's solution to minimize dust and movement was to forbid, except under emergency conditions, any daytime road movement forward of the regimental field trains.[27]

Dust can also pose a serious problem for combat vehicles moving cross-country on the desert floor. It was quickly learned by 3d ACR troopers that if track vehicles didn't follow or "track" each other, dust signature was greatly reduced.[28]

The helicopter's dust signature is the most serious. During JTX Brave Shield VI, for example, CH-47 Chinook helicopters were seen taking off or landing at distances up to 30 km by 3d ACR units.[29] As discussed in Chapter II, helicopters are vulnerable to high performance aircraft. Pilots are well advised to heed the following:

> Dust signature may be reduced significantly by maintaining airspace slightly above transitional lift (about 15 knots). Avoiding extremely dusty areas, like tank trails, will further reduce signature. Many rock deserts (regs) are comprised of desert pavement (well compacted soils) which retard the occurence of dust. These regions are frequently identified on topographic maps and should be actively sought as areas of operation when planning NOE flights.[30]

Diesel exhaust smoke from vehicles and smoke from the firing of weapons also give away vehicle and unit positions to aerial observers. All of our current diesel-engined family of tracked vehicles discharge characteristic plumes of black smoke upon quick acceleration. These smoke plumes can be seen from the air as well as the ground, and can even reveal how many vehicles are involved. For the present, driver training is the only remedy; in the future, however, the U.S. Army

should design exhaust systems to minimize the diesel smoke signature.

Howitzers suffer the greatest smoke signature. The voluminous, characteristic smoke cloud generated upon firing can easily be seen from the air causing a previously well-hidden battery to be seen. No easy solution exists for this significant problem. The best passive defense for the howitzer battery is continual movement to new firing positions--the "shoot and scoot" method.[31] To minimize aerial detection during its movement, the battery must use the already discussed measures of avoiding roads, not "tracking" in cross-country displacement, and rapid camouflage upon reaching the new position.

Personnel-unique measures can either enhance or expose a well-concealed unit by the degree of caution exercised. The following guidelines established by the 3d ACR highlight the problem areas.

i. Personnel
(1) Reduce activity during daylight to the minimum.
(2) When unidentified aircraft are in the area, all personnel must not move.
(3) Do not look up at aircraft.
(4) Do not remove clothes while working. White T-shirts or exposed skin are obvious signatures.
(5) Personnel should use natural camouflage in helmet bands.
(6) CVC helmets should be camouflaged.
(7) Do not stand or lie on vehicles.
(8) Bury all trash in a combat environment.
(9) Do not expose plastic map cases to the sun. They reflect light.
(10) Do not hang out laundry.
(11) Do not form compact groups.
(12) Avoid unnecessary small arms fire to prevent detection by noise.
(13) Avoid unnecessary fires, smoke of light of any kind. At night strict blackout regulations should be enforced.[32]

Conclusions and Recommendations

Without question, only highly trained units that are significantly motivated by the air attack threat can effectively maximize all

of the passive air defense measures discussed. The basic conclusions reached are as follow:

1. Night tactical and resupply operations are the best passive air defense measure.

2. Passive air defense measures can effectively become the primary air defense for:

a. Dispersed armored cavalry troops moving cross-country.

b. Small, effectively camouflaged combat trains.

c. Small, effectively camouflaged mobile command posts which do not have "antenna farms" or helicopter signatures.

3. Passive air defense measures are necessary but least effective for:

a. The large regimental field trains.

b. Howitzer batteries because of their smoke signatures and relative lack of dispersion.

c. Helicopter assembly areas and FARRPs because of the dust and movement upon take-off and landing and the difficulty of camouflaging the aircraft.

Recommendations to improve the passive air defense to the armored cavalry regiment and similar units are as follow:

1. U.S. Army efforts to develop, procure, and issue light-weight, radar-energy-absorbing camouflage nets for each tactical vehicle and aircraft should be accelerated.

2. A means to effectively camouflage a helicopter windscreen should be developed.

3. To reduce the visual and electronic signature of CPs, a requirement exists for a means to remote a RC-292 antenna 1-2 km from its radio.

4. Future design of combat vehicles should include a means to reduce

the diesel smoke signature of exhaust systems.

5. If technically feasible, a smokeless propellant should be developed for the howitzers.

SMALL ARMS FOR AIR DEFENSE (SAFAD)

Introduction

As a community, the U.S. Army has lost the art of shooting down attacking aircraft with organic small arms such as rifles and machineguns. As pointed out by MAJ Herrick in his study "Infantry Small Arms Aerial Target Engagement," U.S. air superiority in wars since W.W. II, and tests during the 1950s and early 1960s, which concluded that small arms would be ineffective against high performance aircraft, resulted in a rush to develop missile air defense to the detriment of small arms.[33] Passive air defense became the only air defense advocated because of the mystique of invulnerability of high performance aircraft to small arms. Tank platoon leaders in the early 1960s, for example, were taught to disperse and "hide" if attacked from the air. The firing of cupola-mounted Cal .50 machineguns was discouraged because it would only serve to expose positions and would be "ineffective" in damaging the attacking aircraft.[34] The resulting apathy of the early 1960s still infects the U.S. Army in spite of attempts to promulgate and disseminate new doctrine based upon lessons learned from Korea, Vietnam and recent Mideast wars. From these wars we know the following:

> In the Korean War, the U.S. Air Force lost over 500 aircraft to small arms and air defense guns, almost 5 times as many as were lost in air-to-air combat. In South Vietnam, the U.S. lost 410 fixed-wing aircraft and 2,100 helicopters. And over North Vietnam small arms contributed to an even greater loss of fighter-bomber aircraft. During the 1973 Middle East War, Israeli small arms alone destroyed over 30 attacking aircraft.[35]

In spite of these historical facts, it is not easy to overcome the inertia of an apathetic attitude toward small arms for air defense (SAFAD) in the U.S. Army. Several excellent air defense publications, however, can assist. For example, Test TC 23-44, How to Train in Small Arms for Air Defense, incorporates the latest techniques in the "volume fire" method which can yield rich dividends on the battlefield.

As in the case of passive air defense, before a SHORAD shortfall can be determined for the ACR, the SAFAD capabilities of the regiment must be determined and maximized.

SAFAD Potential of the ACR

The armored cavalry regiment's potential for SAFAD is enormous. The small arms density of the regiment is as follows:

SAFAD Weapon Systems of the ACR

Weapon System	Authorized H-Series TOE[36]	Authorized European Modified TOE[37]
20mm Automatic Gun	153	0
Cal .50 Machinegun	368	446
7.62mm Machinegun	331	259
Cal .45 Submachinegun	302	263
5.56mm Automatic Rifle	2402	1814
TOTAL	3556	2782

Not surprisingly, the highest percentage (86%) of the heavier crew-served weapons (20mm gun, Cal .50 and 7.62mm machineguns) is found in the ground combat units. Table 2 compares the density of these weapons within the regiment based on the H-series TOE. The 9 armored cavalry troops, as could be expected, possess 69% of the crew-served automatic weapons of the entire regiment. With six Cal .50 machineguns (one per SP Howitzer) and 3 M60, 7.62mm machineguns,[38] the howitzer battery has a relatively limited SAFAD capability when compared to the tank company and

Table 2

ACR Automatic Gun/Machinegun Density (H-Series TOE)

Catagory of Automatic Weapon System	9 Armored Cavalry Troops	3 Tank Companies	3 Howitzer Batteries	Total-Ground Combat & Combat Spt Units	4 Regt/Sqdn HHTs, Air Cavalry Trp
Heavy					
20mm Automatic Gun	94%	0%	0%	94%	6%
Cal .50 Machinegun	51%	19%	5%	75%	25%
Light					
7.62mm Machinegun	76%	15%	3%	94%	6%
TOTAL	69%	14%	3%	86%	14%

armored cavalry troop. With only 14% of the small arms for air defense available among the four headquarters and headquarters troops and the air cavalry troop, the SAFAD capabilities of the softer CPs, aviation assembly areas, and trains formed from these units, is obviously less. This consideration will be a factor as the regimental commander determines his air defense priorities.

The ACR's huge potential for SAFAD is a consideration that must be placed in perspective. SAFAD can supplement, but not replace, SHORAD weapon systems such as Redeye, Vulcan, and Chaparral. When small arms are employed in air defense, it is a personal confrontation between the attacking aircraft and its intended target--SAFAD is really the final protective fires once attacking aircraft have either penetrated or found a gap in HIMAD/LOMAD/SHORAD defenses. Effective training is essential to force the attacking pilot to have respect for SAFAD capability, thus decreasing his confidence and accuracy as he attacks.

SAFAD Training

Several examples from the Mideast War of 1973 demonstrated the training and instinctive reaction of the Israeli soldiers upon being attacked from the air, In the Golan Heights, a 19-year-old tank commander from Haifa told how the Israeli soldiers rushed into their tanks to fire at three Sukhois flying overhead.[39] Their instinctive aggressiveness, just at the sight of enemy aircraft, reflects excellent air defense training.

The following account clearly demonstrates that SAFAD training received by the Israeli soldier leads him to believe that even the Uzi submachinegun can punish an enemy attacker.

> Sergeant Gary Salomon was feeling miserable at 1359. A forward military post in the Golan Heights was a helluva place to spend the holiday. Minutes later he was sucking breath into his lungs, trying to control the wild secretions of adrenalin pumping into his bloodstream, steadying the submachinegun against his waist so that he could spew 9-mm shells at the darting shadows vaulting at him from Syria.... "They came in low, strafing our forward positions. I was scared. I had never been in real combat before. There was so much perspiration between my hands and the Uzi, I thought I was going to drop it."[40]

The instinctive reaction of the Israeli to fire his tank weapons or submachinegun is the kind of reaction U.S. soldiers should imitate. Random firing, however, will produce little. Disciplined soldiers firing their weapons together (volume fire technique) provide the best SAFAD protection.[41] One of many successful Israeli examples from the Mideast War of 1973 is that of COL Nir's tank brigade in the Sinai. In an interview on 25 March 1975, COL Nir described how intense volume fire repulsed an air attack by shooting down 5 attacking MIG-21s. He stressed the psychological impact on pilots of seeing a tracer from every third maghinegun round. COL Nir commented that other units had shot down more attacking airplanes than his brigade, but he was satisfied to see the impression SAFAD made on Egyptian pilots. After his brigade had crossed the Suez Canal and was encircling the Egyptian Third Army, a formation of 11 low-flying MIG-21s spotted his units, but chose not to attack, perhaps out of respect for Israeli SAFAD.[42]

There is nothing magic about the volume fire technique, but training is required. A Human Resources Research Organization (HUMRRO) effort in the early 1960s dealt with a similar procedure for training men to engage aerial targets with the M-14. Twenty men in the grade of E-4 and below competed with a group of twenty more experienced cadre, E-4 and above, of the Infantry School Weapons Department, Ft Benning.

With HUMRRO training, the less-experienced group achieved more than three times as many hits as the more experienced, but untrained cadremen. The HUMRRO training techniques were adopted and published by the Department of the Army in Training Circular (TC) 23-15.[43]

More up-to-date publications exist today such as TEST TC 23-44, How to Train in Small Arms for Air Defense. Using the techniques for volume fire contained in TEST 23-44, several companies of the 1st Battalion, 58th Infantry (Mech), 197th Infantry Brigade (Separate), Ft Benning, used part of a training period at Fort Bliss in May 1974 for SAFAD training. Each platoon used their organic M16 (5.56mm), M60 (7.62mm) and APC-mounted Cal .50 machineguns against radio-controlled model aircraft. With platoon members shooting at small models from various aspects, all targets received multiple hits. The sight of these models crashing in the desert developed great soldier-confidence in the effectiveness of their small arms for air defense.[44] Such training and awareness must become a standard in the U.S. Army.

U.S. SAFAD Weapon System Design

The enormous air defense potential and effective employment of the ACR's 3556 automatic small arms for air defense have been discussed; however, U.S. small arms weapon design for the air defense role has been handicapped by the same apathy that affects our past doctrine and training. As MAJ Herrick correctly puts it, "U.S. Army small arms mounts and sights are not as suitable for the engagement of aerial targets as those used by other countries."[45]

Several examples of the weapon systems of the ACR can be cited. The M139 20mm automatic gun of the M114A1E1 Command and Reconnaissance

Carrier (fully tracked) has a maximum effective range of 1,800 meters against soft targets, and a selectable slow rate of fire of 200 rounds per minute (rpm), and a fast rate of 800-1050 rpm.[46] Although equipped with a sight capable of leading and tracking an aircraft, the traversing and elevating mechanism of the heavy mount is better suited for accurate engagement of ground rather than aerial targets. (The same is true for the Cal .50 weapon system of the M114A1).

Fortunately for the crew of the M114A1E1, a pintle-mounted M60 machinegun is available with a maximum effective antiaircraft range of 350 meters.[47] While more easily employed than the 20mm automatic gun in aerial target engagement, the M60 machinegun lacks a sight to lead and track an aircraft.

Perhaps the worst example of an inadequate air defense weapon is the cupola-mounted Cal .50 machinegun of the tank. The last pintle-mounted tank machinegun was the Cal .50 heavy-barrel machinegun, M2, mounted on the M48. In an antiaircraft role, the Cal .50 machinegun has a maximum effective range of 725 meters.[48] On the M48A1 tank, this machinegun was placed on its side into a tank commander's cupola with a limitation of only 50 rounds per loading. This configuration causes frequent malfunctions and many bruised knuckles of frustrated tank commanders. Like the M139 automatic gun mount, the traversing and elevating mechanism of the cupola is better designed for ground target engagement. The speed rings of the cupola's periscope sight are really useless because of the narrow field of vision. This same cupola configuration continues on the M48A2 and M48A3 series as well. The M60/M60A1 cupolas suffer the same disadvantages of the M48-series cupola in spite of more interior room and the M85, Cal .50 machinegun which was specif-

ically designed for the cupola.

Although the soldiers of the 197th Infantry Brigade (Separate) experienced success in volume fire training with their APC-mounted Cal .50 machineguns, as previously discussed, they did so with a mount that cannot be elevated high enough or that allows smooth tracking of an aircraft.[49] The story sadly continues with the Cal .50 machinegun of the M551 Sheridan found in the armored cavalry platoon.

Test TC 23-44 in effect acknowledges the deficiencies in U.S. small arms design for aerial target engagement. The lack of speed rings are compensated for as follows:

> The rifleman (and M60 and .50 caliber gunner) tries to aim in front by his image of the length of one football field for fast aircraft (jets)(fig 4), one-half a football field in front of slow aircraft (helicopter and fixed-wing)(fig 5).[50]

In reality, the "football field" lead is a field expedient made necessary by our inadequate sights. Other field expedients are used to obtain proper firing elevations. On page 4 of Test TC 23-44, the deficiency of the ground-fired M60 machinegun for air defense use is highlighted by illustrations showing an improved support made of a tree limb, in one case, and in another a soldier holding the bipod of the machinegun to obtain proper elevation.

It is interesting to contrast our small arms with those of the Soviets. With the serious intention of designing their weapons for an air defense role, the PKS 7.65mm machinegun (counterpart to U.S. M60) has an extendable tripod leg which is used as a pedestal antiaircraft mount. The tripod mount of the 12.7mm heavy machinegun is designed primarily for antiaircraft use. Soviet machineguns are designated with offset sights for leading and tracking aircraft. These sights range

from a simple sight with concentric rings for the 7.62mm machinegun, to an elaborate sight for the 14.2mm machinegun which allows a manual adjustment of the number of leads used prior to and during an engagement.[51]

Encumbered by heavy, ineffective mounts on tracked vehicles, and without adequate sights for aerial target engagement, the U.S. Army has an obvious requirement to improve automatic small arms design to maximize its SAFAD capability. One interesting British development along this line is a butterfly sight made of clear plastic with engraved sight rings that can be clipped on their general purpose and light machineguns.[52] Pending such developments, the U.S. will have to rely upon proven field expedients such as football field leads coupled with effective, serious training in the volume fire technique.

Conclusions and Recommendations

Basic conclusions reached concerning small arms for air defense (SAFAD) are as follow:

1. As a supplement to passive and other active air defense measures, properly employed SAFAD can degrade a Soviet air attack by the destruction of aircraft or the psychological effect of tracers employed in volume fire.

2. The armored cavalry regiment, with 3556 automatic weapons ranging from 5.56mm to 20mm, has an enormous SAFAD capability.

3. The highest percentage (69%) of 7.62mm to 20mm automatic weapon capability of the regiment is concentrated in the 9 armored cavalry troops.

4. Realistic, effective training in the volume fire technique, as outlined in Test TC 23-44, must be conducted to produce soldier

confidence and an instinctive, aggressive reaction to air attack.

5. Reflecting an apathetic attitude toward SAFAD in the past, current U.S. Army automatic small arms lack efficient, effective sights and mounts for employment against aerial targets.

Recommendations to improve the effectiveness of small arms for air defense are as follow:

1. Current armor doctrinal publications should be updated to adequately include SAFAD considerations and amplify the techniques outlined in Test TC 23-44.

2. All armor training, ammunition allocations, and unit performance evaluations should include SAFAD.

3. Current automatic small arms and mounts of the U.S. Army should be modified, where possible, to improve sighting and ease of employment against aerial targets.

4. The design of future U.S. Army small arms used for air defense should incorporate efficient sights and mounts for aerial target engagement.

5. Consideration should be given to increasing the percentage of tracer rounds in linked automatic weapon ammunition.

REDEYE

Introduction

Perhaps the most misunderstood, ill-equipped, and abused antiair weapon system available to the maneuver or combat support unit is Redeye. Redeye problems stem from its turbulent beginnings as it was introduced into the U.S. Army. As a SHORAD weapon system, debate in 1958 centered on whether it should be organized in special purpose air defense units

as recommended by the Air Defense School, or as an organic capability responsive to the battalion/squadron commander as advocated by CONARC.[53] The latter position prevailed with the following results.

1. Redeye sections are organic to maneuver and field artillery battalions with teams allocated on the basis of one per troop/company/battery unit.[54]

2. In 1970, Redeye was designated an "all-arms" organization with team members composed of the primary MOS of the parent unit (infantry, armor, artillery).[55]

3. A decision was made in November 1971 to provide an ADA lieutenant to command the section and perform as the battalion/squadron air defense officer.[56]

4. Initially, all Redeye teams and the section headquarters were mounted in M151, ¼ ton trucks.[57] As a result of the "DA Wheel Study," considerable reductions were made which dismounted the majority of Redeye teams.[58]

The debate about whether Redeye should be organic to its battalion/squadron or centralized in an air defense unit continues. Several factors fuel the controversy. A tendency, under the "all arms concept," is to maintain Redeye units below authorized strength during periods of tanker, scout, artillery or infantry MOS shortages in units. The resulting adverse impact on training no doubt prompted LTC Staudemaier's plea in "Air Defense for Armored Leaders" to "... restore Redeye training as the primary mission of the Redeye teams and not divert vehicles and radios to other sections."[59]

Both critics and advocates of the present system acknowledge that the Redeye team member must be an air defense professional

thoroughly knowledgable in aircraft recognition, rules of engagement, weapon status, etc. The training necessary is a full-time mission and much of the debate concerning Redeye centers on this issue. The 82d Airborne Division, for example, centralized their Redeye assets under the division's 3d Battalion, 4th Air Defense Artillery whose commander assumed the "...responsibility for training, maintenance, and command and control of all Redeye assets."[60] While such a system may work for an airborne division which operates with less mobility over relatively small frontages, a dangerous precedent has been set. To permit training deficiencies, difficulties in command and control, and other problems to drive Redeye toward centralized employment loses sight of its fundamental purpose--to provide a continual SHORAD capability to supplement the SAFAD of all maneuver and combat support battalions. A C/V battalion commander, who is faced with priorities that exceed his organic Chaparral/Vulcan capabilities, may attempt to use centralized Redeye to fill gaps. The maneuver or combat support commander may then be deprived of all Redeye for his air defense.

Accordingly, this analysis of Redeye is based upon the following:

> Redeye firing teams assigned to manuever and cannon field artillery units provide an additional means of forward area air defense against aircraft attacking at low altitudes. In consideration of the relatively few Chaparral and Vulcan fire units available to the division for the protection of its critical assets under the current force structure, the battalion and company-size units require their own dedicated air defense weapon--the role fulfilled by Redeye. The Redeye capability, employed in conjunction with organic small arms in the air defense role, gives the unit commander the ability to effectively supplement the protection afforded by air defense units.[61]

ACR Redeye Organization and Equipment

As noted earlier, the regiment has a total of 22 Redeye teams

which are organized as follows:

ACR Redeye Summary

Unit Assignment	No. of Sections	No. of Teams	No. of Gunners* (2/team)	Total Missiles (6/team)
Regimental HHT[62]	1	4	8	24
Squadron HHT[63]	1	6	12	36
TOTAL, ACR	4	22	44	132

* Includes team chief.

On the surface, the capability of the 22 Redeye teams appears to be substantial; however, an analysis of their current vehicle and communication authorization is sobering.

Redeye Equipment Authorizations

Unit	Section Leader		Mounted Teams		Dismounted Teams	
	No.	Vehicle/Radio	No.	Vehicle/Radio	No.	Radio
Regt HHT[64]	1	M561, 1¼ ton AN/VRC-47	1	M151, ¼ton w/ trailer AN/GRC-160	3	AN/PRC-77
Sqdn HHT[65]	1	M561, 1¼ ton	2	M151, ¼ton w/ trailer AN/GRC-160	4	AN/PRC-77
TOTAL, ACR	4	M561, 1¼ ton AN/VRC-47	7	M151 ¼ton w/ trailer AN/GRC-160	15	AN/PRC-77

Observations concerning the above tabulation are as follow:

1. Only 32% (7 of 22 teams) of the regiment's Redeye teams are mobile.

2. The M151 vehicle authorized the mounted teams has limited cross-country capability and offers no armor protection.

3. All radios of the Redeye sections are FM with the following capabilities.

a. The AN/VRC-47 of the section leader is capable of monitoring two nets and transmitting on one of these nets to a planning range of approximately 41 km.[66]

b. The AN/GRC-160 and AN/PRC-77 radios of the Redeye teams have a single net capability with a transmission planning range of only 8 km.[67]

4. The M561 of the section leader is a poor command and control vehicle because its awkardly mounted radios are useless as a result of high engine noise level.[68]

To realistically assess the capability of Redeye to supplement SAFAD and other SHORAD systems, the preceeding equipment considerations must be viewed within the mission and operational environment of the ACR. Results of 3d ACR training at Ft Bliss can assist in this assessment. A major field training exercise, FTX Brave Rifles VII, during the period 18-25 Feb 1974, considered Redeye as well as other air defense problems. Two of the Redeye questions addressed were:

- Is the MTOE radio configuration of the Redeye section adequate?
- Are the Redeye teams properly mounted?[69]

The conclusions and recommendations reached during this exercise were forwarded by letter to MG C.J. Le Van, Commander of the U.S. Army Air Defense Center and Ft Bliss, on 5 April 1974. The letter was signed jointly by the commanders of the 3d ACR and 11th AD Group. The contents of the letter, later published in the June 1974 issue of Air Defense Trends, will be cited when appropriate in this analysis.

Redeye System Capabilities and Employment

With a basic load of six missiles, the 2-man Redeye team (gunner and team chief) is the key to Redeye employment. With a maximum effective range of 3 km[70] and a limited head-on engagement capability, the employ-

ment of the heat-seeking missiles requires positioning well forward of the defended critical asset to obtain early engagement of attacking aircraft. When employed as a section, the teams are located approximately 2 km apart and 1 km from the defended asset to insure overlapping fires and destruction of attacking aircraft before release. Similarly, Redeye should be positioned at the front and rear of a defended march column.[71]

Although the entire Redeye section can adequately defend a single critical asset, the section leader, based upon the commander's priorities, may choose to attach teams to each troop, company and battery.[72] In this case, Redeye does not possess sufficient mass to protect a critical asset, but it can effectively supplement SAFAD. When operating over the wide frontages of a dispersed armored cavalry squadron, great demands are placed on the section communications.

Redeye Communications

The Commander's Guide to Redeye states that the Redeye section has a requirement to operate a section net for command guidance and information flow for and between teams. Further, the "... section headquarters monitors two other nets: its parent battalion command net and an FM broadcast net operated by the C/V battalion AADCP."[73] However, as noted earlier, the AN/VRC-47 radio of the section leader can monitor only two nets simultaneously. This contradiction poses a significant problem for the section leader who must decide which one of the three nets he will not monitor.

The Redeye team, with its AN/GRC-160 (mounted) or AN/PRC-77 (dismounted) radio suffers from a limited range capability and the

inability to operate on a section command net while concurrently monitoring a C/V battalion Early Warning Net (FM). The Redeye team, as a SHORAD air defense element, should possess radio capabilities comparable to the Chaparral or Vulcan fire unit which has the AN/VRC-47 radio.[74]

After many field expedients were tried during FTXs at Ft Bliss, the 3d ACR reached the following conclusion during Brave Rifles VII (18-25 Feb 75).

> The MTOE radio configuration of the Redeye section is totally inadequate. The AN/PRC-77 radio remaining with the Redeye Team since the ill-advised loss of vehicles due to the DA Wheel Study simply lacks the range necessary to operate over extended frontages. The AN/VRC-47 radio should be available to every team. The auxiliary receiver would allow the team to net with the FM Early Warning capability of the C/V battalion, thus becoming fully complementary and integrated with Chaparral/Vulcan.[75]

Redeye Mobility

Ideally, Redeye should possess the mobility espoused in the following quotes from two separate ADA publications.

> The principle of mobility means simply that all air defense weapons, including Redeye, must have a mobility equal to the mobility of the force they are supporting if they are to accomplish their tactical mission successfully.[76]

> Redeye moves with the troops--providing continuous and responsive air defense.[77]

With only 32% of the ACR's Redeye teams mounted, an obvious contradiction between theory and actual capability exists. Another ADA publication acknowledges the existing lack of Redeye mobility in the case of march column defense by stating:

> Because the Redeye team doesn't have its own vehicle, it will have to hitchhike.[78]

The idea of a Redeye team "hitchhiking," complete with six

missiles, radio with spare batteries, individual weapons, and personal gear, is ludicrous! Even more bizarre is the consideration that the immobility of Redeye may dictate how an attack march column must react to an air attack.

> The Redeye team may have to dismount to fire at the aircraft. This means the convoy must stop or disperse.[79]

The 15 dismounted Redeye teams of the ACR suffer additional disadvantages in a fast-moving, fluid tactical situation. If a protected asset, such as a howitzer battery, continually moves to new locations, the Redeye Teans may be able to "hitchhike" to the new firing location, but from there have to walk the 2 km necessary to their own position well-forward (or in the probable direction of attack). In situations of continual displacements, fatigue may seriously degrade their effectiveness.

Additionally, the properly deployed Redeye team may find itself unable to obtain transportation in a tactical emergency. The supported unit may simply be unable to retrieve them in the heat of battle.

3d ACR attempts to cope with Redeye immobility, by dedicating "scrounged" vehicles from other sources or by "hitchhiking," were frustrated and resulted in the following conclusion from FTX Brave Rifles VII.

> Redeye Teams are improperly mounted. Four of the six teams at squadron level should have the tracked, cross-country capability of the M113A1 in order to protect the maneuver units. Additionally, the M113A1 offers sufficient basic load space and the mounting space for the required AN/VRC-47 radio configuration. The 3d ACR will recommend these as MTOE changes as well as a RC-292 antenna for the section leader to better communicate over extended distances.[80]

Redeye Survivability

The original decision to mount Redeye Teams in soft wheeled

vehicles must have been forced by other than tactical considerations. A Soviet or Soviet-equipped enemy will certainly saturate the battlefield with artillery. As presently mounted, it is inconceivable that a Redeye team and its missiles can move with a maneuver unit if unprotected from small arms fire and fragmentation from artillery and air-delivered weapons. If Redeye teams are to protect combat units, they must have equivalent armor protection and cross-country capability. The M113 armored personnel carrier is an obvious solution to provide requisite mobility and increased survivability.

Current Redeye Trends

Many of the problems described in this Redeye discussion have been addressed by the ADA community as follows:

1. Headquarters, Department of the Army has favorably considered the termination of the "all arms" manning of Redeye teams in favor of incorporating gunners into the 16P (air defense) MOS series. Implementation is planned for calendar year 1975.[81] This proposal should assist in correcting Redeye training and manning abuses.

2. Concerning mobility, the U.S. Army Air Defense School has recommended that the M113 APC be authorized for each Redeye team. The Air Defense School concurred in retaining the M561 Gama Goat for the Redeye section headquarters, however.[82]

3. A required operational capability (ROC) will be developed for a light-weight AM receiver for Redeye that will be compatible with the future ADA early warning system.[83]

Conclusions and Recommendations

Conclusions concerning Redeye of the armored cavalry regiment

are as follow:

1. The SHORAD capability of Redeye should remain organic to the squadron and regimental headquarters troops for maximum responsiveness to the commander.

2. Incapable of area defense, the Redeye section can protect a single critical asset or supplement the SAFAD capability of each troop/company/battery of the regiment.

3. As currently equipped in the ACR, Redeye lacks the requisite mobility, survivability, and communications to perform its mission.

Recommendations to improve Redeye capability in the ACR are as follow:

1. The U.S. Army Armor School should strongly support the recommendation of the U.S. Army Air Defense School that all Redeye teams assigned to armored and mechanized units be provided the M113A1. Additional consideration should be given to eliminating the M561 of the section leader and providing him a M113A1, as first preference, or the M151 with trailer as second preference.

2. All Redeye teams should be provided the AN/VRC-47 with the auxiliary FM receiver for early warning, etc. Upon the development and issuance of an AM early warning receiver, the Redeye team should be equipped with the AN/VRC-46 (no auxiliary FM receiver).

3. The Redeye section leader should be issued an RC-292 antenna to improve his command and control of Redeye teams operating over extended distances.

SUMMARY

Based upon the analysis in this chapter, the armored cavalry

regiment divides into approximately 26 critical assets or "targets." These range from armored cavalry troops to small, highly mobile CPs. According to current air defense doctrine, a C/V platoon or Redeye section is the minimum SHORAD requirement to defend a troop/company/battery critical asset.

Much can be achieved by denying the enemy aerial detection of his critical assets by use of passive air defense measures such as night operations and camouflage. Passive measures are most effective for armored cavalry troops, command posts (CPs), and combat trains; howitzer batteries, helicopter assembly areas, and the large field trains offer the toughest problem in this area.

With a tremendous SAFAD potential of 3556 automatic small arms, the regiment's "final protective air defense fires," particularly of the armored cavalry troop, command respect. Through serious training in aggressive volume fire, the regiment can effectively destroy attacking aircraft or degrade their bombing accuracy.

With a capability of defending four critical assets, the Redeye sections offer the regiment a limited, but significant SHORAD capability. Whether employed as a section, or as dispersed teams, Redeye supplements SAFAD and vice versa.

Even after maximizing the passive and active measures available, the regiment is not adequately protected from low altitude air attack. Chapter IV will provide the vehicle to discuss air defense priorities of the regimental commander, and to determine its SHORAD requirement.

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CHAPTER IV: DESERT SCENARIO--SHORAD REQUIREMENT

INTRODUCTION

The Soviet low altitude threat determined in Chapter II, and the discussion in Chapter III of the ACR as a target with organic air defenses, provide the basis for analyzing the regiment's SHORAD requirement in this chapter. As noted in Chapter I, a desert scenario will be developed to provide a vehicle to analyze the ACR's air defense needs when acting as a corps covering force.

The following scenario is similar to those developed at Ft Bliss for CPX and FTX purposes. The distances discussed are realistic and have been proven during actual field exercises. The lessons learned by the 3d ACR and 11th AD Group have often been learned the hard way--through trial and error.

Neither the tactical scenario nor the air defense priorities determined within the scenario are sacrosanct. Typical of the military art, no "quick and dirty" method exists to determine a commander's air defense priorities within a given tactical situation. In short, the process is subjective--there is no approved solution.

A FORT BLISS DESERT SCENARIO

General Situation

On 15 May ____, the Warsaw Pact nations invaded West Europe and enjoyed initial success, then stalled due to a limited tactical nuclear exchange. Both sides, fearing an escalation to a strategic

nuclear exchange, have ceased employing nuclear weapons. The result has been stalemated conventional warfare. The People's Republic of China has declared itself neutral and is not involved. U.S. intelligence sources indicate that the PRC has assured the Soviet Union that no attempt will be made to take advantage of the European situation in the disputed Sino-Soviet border areas.

To prevent a major U.S. reinforcement of NATO, the Soviet Union launched a surprise invasion on 20 June ____ of Canada with several combined arms armies previously garrisoned on the PRC-USSR border. The Soviets intended to quickly drive a wedge into relatively unpopulated CONUS areas along an axis south to Denver, Colorado, then to the Mexican Border in the vicinity of El Paso, Texas. NORAD headquarters at Colorado Springs, Pueblo Army Depot, Sandia Base, NM, Holloman AFB, NM, White Sands, NM, and the Air Defense Center at Ft Bliss appear to be high on their list of objectives.

Stiff resistance by the 9th Infantry Division (Ft Lewis, WA), the 4th Mechanized Division (Ft Carson, CO) and Reserve Component units were unable to prevent the Soviet seizure of the Denver area by tank-heavy forces. In another surprise move, several Soviet airborne divisions seized the Albuquerque, NM, area along with the northern New Mexico mountain passes leading south to the Mexican border.

Because time did not permit reinforcement of the 4th Mech Div in the Denver area, the U.S. assembled Ft Hood's III Corps at Ft Bliss, where it will be augmented by the 3d ACR and 11th AD Group. By 30 July ____, the 2d Armored Division, 1st Cavalry Division, 6th Air Cavalry Brigade, and supporting units had deployed to the El Paso-Ft Bliss area by rail and air movement. The 49th Armored Division of

Texas (ANG) is presently formed and training for commitment at Ft Hood. The movement of III Corps Artillery units at Ft Sill has been delayed, but a Reserve Marine 8" howitzer field artillery battalion in El Paso will be available.

As in Europe, neither side has achieved air superiority. Both sides can achieve local air superiority and both have a heliborne capability.

Following the precedent in Europe, fear of a strategic nuclear exchange has led to no tactical nuclear weapon exchanges in CONUS. The U.S., however, has not ruled out the possibility of using tactical nuclear weapons on its soil if no recourse is available. No chemical or biological weapons have been employed to date.

III Corps Situation

The National Command Authority has assigned the following mission to the Commander, III Corps.

ESTABLISH IMMEDIATE CONTACT WITH AND DESTROY ALL ENEMY FORCES ALONG THE AXIS EL PASO-ALBUQUERQUE-DENVER.

Because Soviet airborne raids and heliborne forward detachments have already been reported as far south as Holloman AFB-Alamagordo, NM, the corps commander has decided to begin his movement to contact to the north without waiting for III Corps Artillery to arrive. Based on his intelligence reports, he will move through the Tularosa Valley with his two divisions abreast, the 3d ACR as the advance covering force, and the 6th Air Cavalry Brigade as the west flank covering force (See Map 1, III Corps Movement to Contact).

3d ACR Situation

After receiving the III Corps operation order and overlay, the III Corps G3 takes the 3d ACR commander aside and informs him of the following:

> The corps commander, as you have heard, is seriously concerned about the air attack threat. He feels the Nike Hercules and Hawk units from Ft Bliss can handle the HIMAD/LOMAD aspect, but SHORAD, particularly in your case, is a problem. Because of your mission as the advance covering force, you will be subject to intensive air reconnaissance and bombing. As the first to be overflown and seen by the enemy, the corps commander wants you adequately protected from low altitude attack. How much Chaparral/Vulcan will you need? How about giving this some thought and getting back to me ASAP?--C/V assets are scarce, so we'll need a "defendable" answer.

The regimental commander, rather than give a hasty answer, returns to his CP to study the corps order and consider his own air defense capability. The lack of U.S. air superiority, coupled with his exposure as the leading III Corps unit, poses a significant problem. Even the lead elements of his armored cavalry troops will receive more attention than normal from Soviet aviation because they will initially be out of range of Soviet artillery. An additional factor is the vulnerability of his CPs, trains, and artillery batteries to the Soviet's aggressive use of heliborne and airborne operations.

To visualize his dispositions, he projects how his deployed regiment will appear sometime during the first day of execution (See Map 2, 3d ACR Advance Covering Force). Based upon his experience, the regimental commander knows he can move cross-country on the Tularosa Valley floor at 6 km/hr if unopposed or against light resistance. Visualizing his lead ground elements at PL THOR, the commander knows that his field trains and aviation assembly areas will be some 20 km to the rear along PL ZEUS. The 20 km depth of the regiment would be normal.

Scenario Assumptions

The deployment graphically portrayed in Map 2 will be that utilized for the remainder of Chapter IV. In order to maximize the passive and active air defenses considered, the following assumptions are made.

1. The ACR troops are fully trained in passive air defense measures. Sufficient quantities of camouflage paint and nets are available.

2. The ACR troopers are fully trained in using their automatic weapons in the volume fire technique of engaging aerial targets, and will instinctively employ SAFAD when attacked.

3. Redeye sections have the requisite mobility, communications, and armor protection afforded by the M113A1 to accomplish their missions with forward deployed units.

Having determined the tactical situation and assumptions, the priorities for air defense must be established to continue a logical process to determine the ACR's SHORAD requirement.

PRIORITIES FOR AIR DEFENSE

Introduction

It is the responsibility of the regimental commander to determine the air defense priorities for the ACR. These priorities must clearly indicate to the supporting air defense commander, whether a Redeye section leader or C/V commander, which critical assets he wants protected in order of priority. Based upon the regimental commander's stated air defense priorities, the air defense commander will task organize as he sees fit. If air defense assets are limited, only the first priority may receive protection, thus emphasizing the importance

of the decision.

In establishing his priorities, the regimental commander will consider the importance of all his assets to the successful accomplishment of the regiment's mission--in this case, as a corps advance covering force. For this reason, his stated priorities will include squadron assets, thus dictating priorities to subordinate commanders. The establishment of common priorities throughout the regiment will facilitate the task organization and employment of any air defense unit SHORAD systems when available.

Statement of Air Defense Priorities

As a discussion vehicle, one of many possible statements of air defense priorities will be made, then analyzed. The decision and analysis are not all inclusive. They do reflect the considerable thought given to air defense priorities by commanders and staffs of the 3d Armored Cavalry Regiment at Ft Bliss. Although different commanders will certainly not agree in all considerations or conclusions, the following thought process is a good method to be applied in nearly all typical ACR missions.

For the purpose of this analysis, each critical asset will be evaluated in terms of:

- Criticality to regimental mission.
- Soviet air attack priorities.
- Capability to avoid aerial detection (passive measures).
- SAFAD capability (self-defense).
- Vulnerability to aircraft ordnance (armor protection).
- Recuperability if attacked.

With his mission as an advance covering force in mind, the regimental commander evaluates each of his assets in the above terms. He announces his decision as follows:

"I want these critical assets defended from air attack in the following order of priority.
1. Howitzer batteries.
2. Tank companies.
3. Field trains.
4. Command posts."

The following could be his rationale.

1st Priority--Howitzer Batteries

The long range conventional and nuclear fires of the howitzer batteries are essential for accomplishment of the regimental mission. As targets are detected by aeroscouts of the air cavalry troop, or by elements of the armored cavalry platoons as they conduct zone reconnaissance and move to contact, they immediately call for artillery. The continuous availability of responsive, accurate 155mm indirect fire is a vital ingredient in developing the enemy situation, reducing his positions, confusing his planned operations, breaking up his formations, and destroying him at minimal cost. If the enemy has sufficient combat power to overwhelm the light reconnaissance elements, artillery may be the most efficient means to disengage them. If nuclear weapons are employed, the howitzer battery is the only regimental unit that is nuclear capable. In short, the howitzer batteries are critical for mission accomplishment and irreplaceable from regimental assets.

Of all the regiment's assets, the Soviet pilots will key first on the howitzer batteries because of their nuclear capability. As noted in Chapter II, this Soviet priority will be unchanged regardless of the situation.

The smoke signature upon firing, and the frequent displacement of the batteries will frustrate their ability to deny aerial detection through passive measures. Any Soviet pilots "hunting" for targets of opportunity may well pick up a battery's signature and attack. Because of the relative lack of dispersion available to a battery, the conventional ordnance delivered by a flight of four attacking aircraft could destroy the entire battery. The recuperability of the battery is slight because the howitzers are unique and of low density in the regiment.

The inherent self-defense (SAFAD) capability of a howitzer battery is limited. The 6 Cal .50 machineguns of each howitzer and the 3 M-60 machineguns can achieve limited volume fire, but at a cost, While defending itself from air attack with SAFAD, the howitzer battery is not supporting the maneuver elements by fire.

The howitzer and FDC tracks have light armor protection enabling them to withstand near misses. On the other hand, the ammunition vehicles lack overhead protection, and any ammunition prepared for firing near the howitzers is also vulnerable. None of the battery's vehicles can withstand strafing from the 23mm (or larger) cannon of Soviet aircraft. Finally, the battery is highly vulnerable to a heliborne raid. Unlike Vietnam, the battery must rely upon its own assets for local security and defense when the squadron is part of the advance covering force.

In summary, the howitzer batteries receive first priority for air defense because of their critical contribution to mission accomplishment; designation as the first priority for Soviet air attack; their difficulty to conceal by passive measures; limited SAFAD capability; vulnerability to strafing, conventional bombs and airmobile raids; and

lack of recuperability.

2d Priority--Tank Companies

Normally, no regimental reserve is retained when conducting an advance covering force mission over extensive frontages. Each squadron, however, will usually retain its tank company as a local reserve. The regimental commander may "put a string" on the tank company by requiring his permission before commitment, but its employment would remain basically unchanged. Centrally positioned within a squadron zone, the tank company can be used to deliver a quick, "knockout punch" to a stubborn point of resistance. As the squadron heavyweight, the company may be committed to reinforce a heavily engaged troop, counterattack to reduce a penetration, or be used to permit disengagement of a decisively engaged reconnaissance element. To perform effectively as a quick-reacting, timely reserve, the company must be able to rapidly move unimpeded by air attack. As the reserve, the tank company may well be the key to successful accomplishment of both the squadron and regimental missions.

Although the Soviet pilot may not recognize the tank company as local reserve, the rapid movement of the entire company upon its commitment may attract his attention. Whether or not the Soviet pilot recognizes the moving tanks as his second attack priority (reserve), he will most likely attack such a target possessing significant combat power.

Upon commitment, the movement of the tank company will compromise its passive measures to avoid air detection. If detected and attacked, the tanks can deliver a high volume of fire (SAFAD) that would dis-

courage most enemy pilots. However, the tank company may have its timing disrupted by having to defend itself, thereby preventing its effective use as a local reserve.

Of all critical assets, the tank company is the least vulnerable to conventional aircraft ordnance. Impervious to 23mm cannon strafing on its heavy frontal armor, the medium tank can also withstand all but a direct hit from a large bomb. Similar to the howitzer battery, the tank company is unique, but its higher equipment density and inherent armor protection give it good recuperability.

In conclusion, the tank company is critical to successful accomplishment of the regiment's mission. Upon its commitment as a local reserve, the company can ill afford to be held up by air attack and should therefore have its significant SAFAD fires supplemented by a quick-moving SHORAD capability.

3d Priority--Field Trains

As noted earlier, the majority of the logistical capability of the regiment is found within the 200+ vehicles of the field trains. Although the loss of a good portion of the trains may not affect immediate combat operations, a severe air attack could certainly affect mission accomplishment within 24 hours. Just the loss of a few POL vehicles, several wreckers, or a Sheridan (M551) missile test equipment van could prove a critical blow to combat operations. Recuperability of these unique, specialized assets is extremely low.

Although not listed by COL Sidorenko as a priority air attack target, Soviet pilots would certainly attack the field trains as a lucrative target.

Even though passive measures can be quite effective, the sheer size of the field trains increases its probability of detection. Extremely "vulnerable" as a target, the "soft" field trains elements possess little SAFAD capability. Additionally, the field trains offer a tempting target for a heliborne attack. All of these factors promote the field trains as the third priority for air defense.

4th Priority--Command Posts

The command post of both the squadrons and regiment are obviously important to the command and control of dispersed regimental assets. The sudden destruction of a CP can cause a momentary loss of command and control. If fortunate, the commander and his command group may be operating apart from the CP with no loss of command and control. A more serious lapse of command and control can result if the commander is lost along with his CP. The vital function of command and control will be restored as soon as subordinate units realize the situation, and the headquarters of the next senior commander assumes control. This back-up capability adds to the inherent recuperability of the CPs.

As determined in Chapter II, the regimental and squadron CPs are the third Soviet air attack priority. It is obvious the Soviets recognize that the loss of vital command and control installations can result in a body trying to function without its head.

Countering the Soviet desire to sever the "head" is the previously discussed effectiveness of CP passive air defense measures. The passive measures of small size, cross-country mobility, night displacements, remoted antennas, reduced helicopter activity, and camouflage should be the primary means of CP air defense.

On the negative side, the small SAFAD capability of CPs limits their self-defense. The armored vehicles of the regiment's CPs are vulnerable to Soviet 23mm strafing and conventional bombs. Like the howitzer battery, the CPs are also susceptible to heliborne raids.

Even though passive air defense measures are extremely effective, the CPs are designated as the fourth priority for air defense because of their critical mission of command and control.

The command post is the last specifically designated priority, for air defense resources will most likely be exhausted to adequately protect those already designated. The remaining critical assets are considered, but for this mission do not have sufficient justification to be listed among the four top priorities.

Critical Assets Without Air Defense Priority

Although the 9 armored cavalry troops are the heart of the regiment, their natural dispersion, other passive measures, and high density of SAFAD provide them the best inherent air defense protection of the regiment. It is highly unlikely that an attack by four Soviet attack aircraft could neutralize a troop and prevent its continuation of the mission. The troop inherently possesses excellent recuperability.

The combat trains, like the command posts, can rely upon passive air defense measures for their primary protection. Because they consist of minimal logistical items for emergency resupply, their destruction would not be a critical loss affecting mission accomplishment.

The aviation assembly areas of the armored cavalry regiment contain high-cost assets and merit a hard look. The air cavalry troop provides a true vertical dimension to the capabilities of the regiment.

The speed and flexibility of the air cavalry troop must be balanced, however, by other factors when considering air defense priorities. Very little of the regiment's combat power is found in the air cavalry troop. The ACR cannot rely upon continual employment of the air cavalry troop because of aircraft limitations in bad weather (desert wind, for example), limited night operational capability, vulnerability to SAFAD/SHORAD, and high logistical requirements. Similarly, the majority of regimental command and control will be accomplished from armored vehicles, not the helicopter. Finally, the helicopter resists passive air defense measures as noted in Chapter III. Bluntly stated, the operational capability and combat power of helicopter assets simply don't equate to those of the howitzer battery or tank company. The loss of all 49 helicopters would not seriously degrade the regiment's accomplishment of its advance covering force mission. As will be seen later, however, the air defense of the aviation assets will not be ignored.

SHORAD REQUIREMENT

Air Defense Adequacy Without C/V SHORAD

Having considered maximum passive and active air defense measures, and with his priorities determined, the regimental commander must determine the adequacy of his air defense. For the purpose of this analysis, the following definitions will apply.

Adequate--Critical asset has a high probability of either denying aerial detection or, if attacked, effectively defeating a low altitude air attack by four Soviet aircraft. Asset has a high probability of effectively continuing its mission if attacked.

Marginal--Critical asset has a fair probability of either denying

aerial detection or, if attacked, defending itself. Asset has a fair probability of effectively continuing its mission if attacked. Inadequate--Critical asset has a low probability of either denying aerial detection or, if attacked, defending itself. Asset has a low probability of effectively continuing its mission if attacked.

Using the preceding definitions, the air defense adequacy of the ACR without C/V is shown in Table 3. As assumptions in this case, the entire regimental Redeye section is committed to defend the field trains; the squadron Redeye is split between priorities 1 (Howitzer Btry) and 2 (Tank Company) to provide some SHORAD protection.

Air Defense Shortfall

Based upon Table 3, the adequacy of air defense can be summarized as follows:

Air Defense Protection	Number of Critical Assets
Adequate	9
Marginal	14
Inadequate	3

At this point, the shortfall requiring SHORAD protection occurs among the 14 marginally and 3 inadequately protected assets. These 17 assets do not necessarily require a minimum of a C/V battery as in the case of the huge field trains. The tank company, for example, should require no more than one SHORAD platoon. The minimum SHORAD requirement for each critical asset is shown in Table 4. As noted in the "remarks" column, the entire Redeye sections are assumed to be protecting the command posts, thus providing them adequate protection.

Table 3

Air Defense Adequacy Without C/V

Critical Asset	No	Primary Air Defense	Secondary Air Defense	Adequacy of Air Defense
Regiment:				
Command Post	1	Passive	Limited SAFAD	Marginal
ACT Assembly Area	1	Passive	None	Inadequate
ACT FARRP(daytime)	1	Passive	None	Inadequate
HHT Aviation Plt	1	Passive	None	Inadequate
Field Trains	1	Regt Redeye Sect	Passive	Marginal
Squadrons (3):				
Command Post	3	Passive	Limited SAFAD	Marginal
Combat Trains	3	Passive	Limited SAFAD	Marginal
Armd Cav Troop	9	Passive	SAFAD	Adequate
Tank Company	3	2 Redeye Teams SAFAD	Passive	Marginal
Howitzer Battery	3	4 Redeye Teams SAFAD	Passive	Marginal

Table 4

SHORAD Requirement By Critical Asset

Critical Asset	SHORAD Requirement (Platoons)	Remarks
Regiment:		
Command Post	N/A	Redeye Section Available
ACT Assembly Area	1	Low AD Priority
ACT FARRP	N/A	C/V Unable to Accompany
HHT Aviation Platoon	1	Low AD Priority
Field Trains	3	Full Battery Required
Squadrons (3):		
3 Command Posts	N/A	Redeye Section Available
3 Combat Trains	3	
3 Tank Companies	3	
3 Howitzer Batteries	3	
TOTAL	14	

Conclusion

Without consideration of mix, the SHORAD shortfall of the ACR equates to 14 platoons. A C/V battalion presently has a total of 12 platoons organized into four batteries.[1] Since the air cavalry troop and regimental aviation platoon assets have a relatively low air defense priority, dedicated SHORAD protection is not essential. Therefore, the first conclusion reached is as follows: FOR ADEQUATE AIR DEFENSE PROTECTION, THE ARMORED CAVALRY REGIMENT REQUIRES A MINIMUM OF ONE C/V BATTALION.

DESIRED MIX OF THE CHAPARRAL/VULCAN BATTALION

Introduction

Having determined a need for at least 12 C/V platoons of one C/V battalion, the type and mix of the battalion is germane. Presently, the divisional C/V battalion has two self-propelled Vulcan batteries, each with three platoons. The other two batteries are self-propelled Chaparral, also organized into three platoons per battery.[2] The nondivisional C/V battalion is similar except the Vulcan batteries have towed weapon systems and the battalion does not have an organic air-space control element (ACE).[3]

Before considering what mix is appropriate, the capabilities of the Chaparral and Vulcan systems must be compared. As a multibarreled 20mm gun system with an effective range of 1.5 km against aerial targets, the Vulcan also has a ground defense capability effective out to 5 km.[4] The SP Vulcan (modified M113 APC) has a rapid reaction capability and the ability to keep up with maneuver elements.[5] Because of its cross-country mobility, light armor protection, and ground defense capability,

the Vulcan is ideal to protect forward combat elements of the cavalry regiment and offers an effective counter to heliborne operations.

Like Redeye, the Chaparral missile system has the limitation of being a tail chase system, so it must be positioned away from the protected asset.[6] Better employed in defense of relatively stationary assets, the four Chaparral systems of a platoon must be mutually supporting (overlapping coverage) because of their suceptibility to defeat-in-detail. A more ideal situation is a mix of Vulcan and Chaparral to enhance survivability.[7] Mounted on a M113-family tracked vehicle, the Chaparral missile system has a range of 5 km.[8]

All of the SHORAD systems (Chaparral, Vulcan, and Redeye) available to the regiment are daylight, fair weather, line-of-sight systems.[9] This is a severe and sobering limitation when considering the Soviet emphasis on night heliborne operations and night air attack described in Chapter II. The visual signatures generated upon firing Chaparral and Redeye missiles are an additional factor to be considered in SHORAD employment. The smoke and dust created are visible from the ground and air, thus dictating the use of alternate firing positions. To insure survivability of Chaparral and Redeye systems, movement to the alternate positions is accomplished as soon as tactically feasible after an engagement.[10]

C/V Battalion Mix of 1 Chaparral/ 3 Vulcan Batteries

The most efficient mix of Chaparral/Vulcan appropriate for an ACR is difficult to define. As experience increased at Ft Bliss between the 3d ACR and 5th Bn, 59th AD Artillery (C/V)(SP), concepts changed. As a divisional-type C/V battalion, the 5-59th ADA has two SP Vulcan

batteries and two SP Chaparral batteries. In 1972-73, the Vulcan was viewed as a system far superior to the Chaparral for protection of the cross-country movement of cavalry units. Because the C/V battalion has only two Vulcan batteries, task organization to composite batteries of a C/V mix was a natural evolution to provide some Vulcan for all three squadrons.

During FTX Brave Rifles VII, 18-25 February 1974, the 5-59th ADA (C/V) supported the 3d ACR operation as a corps advance covering force over the same terrain and frontages as the scenario in this chapter. The C/V battalion commander provided one composite C/V battery (DS) to each squadron consisting of 1 Chaparral and 2 Vulcan platoons. The fourth battery remained pure Chaparral and protected the field trains.[11] As a result of this exercise, the 3d ACR and 11th AD Gp commanders jointly determined that the best mix for a C/V battalion supporting an ACR was as follows:

> The mix of Chaparral and Vulcan batteries within a C/V battalion should be changed from 2 Chaparral, 2 Vulcan to 1 Chaparral, 3 Vulcan. Such a reorganization will enable the C/V battalion commander to continue to weight Vulcan forward while at the same time retaining the capability of a C/V mix for the regimental trains or as needed elsewhere.[12]

It is interesting to note that a 1973 student staff study at the U.S. Army Air Defense School reached a similar conclusion concerning mix. CPT Gerron, after consulting with the 3d ACR, determined that four batteries should be assigned as organic assets to the ACR. He concluded that a pure Vulcan battery should be organic to each squadron similar to the present howitzer battery. CPT Gerron also recommended that a composite battery of 1 Vulcan/ 2 Chaparral platoons be organic to the regimental headquarters and headquarters troop.[13] Similar to the

conclusion reached in FTX Brave Rifles VII, pure Vulcan was recommended to support the three squadrons; Chaparral was considered better suited for the protection of the rear elements.

The scenario developed in this chapter can be used to analyze a C/V battalion mix of 1 Chaparral/3 Vulcan batteries (See Map 3). In this case, each Vulcan battery is in direct support of the squadron; the Chaparral battery protects the regimental field trains. Within each squadron, 2 Vulcan platoons are assumed to be protecting the howitzer battery (1st priority) due to its frequent displacement by echelon. The third platoon protects the tank company as the local reserve (2d priority). The squadron CP, as the next squadron priority, is protected by the Redeye section. The combat trains, however, are still marginally protected and the maneuver units lack Redeye to complement SAFAD.

Because of the 5 km missile range, the pure Chaparral battery affords more than just protection for the field trains. By consciously positioning the regimental CP and aviation assembly areas within Chaparral coverage, some protection is derived (See Map 4). The Redeye section can be relieved of total commitment to the regimental CP and can be distributed as shown on Map 4. The aviation assets are thus upgraded to a marginal degree of protection. Table 5 reflects the resulting air defense adequacy of the 1 Chaparral/ 3 Vulcan battery protection for the entire regiment.

A comparison of Table 3 and Table 5 yields the following:

Air Defense Protection	Without C/V	With 1 Chap/3 Vulcan Batteries
Adequate	9	20
Marginal	14	5
Inadequate	3	1

Table 5

Air Defense Adequacy With 1 Chaparral/ 3 Vulcan Batteries

Critical Asset	No	Primary Air Defense	Secondary Air Defense	Adequacy of Air Defense
Regiment:				
Command Post	1	Passive	Redeye Section Limited SAFAD	Adequate
ACT Assembly Area	1	Passive	None	Marginal
ACT FARRP(daytime)	1	Passive	None	Inadequate
HHT Aviation Plt	1	Passive	None	Marginal
Field Trains	1	Chaparral Battery	Passive	Adequate
Squadron (3):				
Command Post	3	Passive	Redeye Section Limited SAFAD	Adequate
Combat Trains	3	Passive	Limited SAFAD	Marginal
Armd Cav Troop	9	Passive	SAFAD	Adequate
Tank Company	3	1 Vulcan Plt SAFAD	Passive	Adequate
Howitzer Battery	3	2 Vulcan Plt	Passive	Adequate

A C/V battalion of 1 Chaparral/ 3 Vulcan batteries is an obvious improvement as all priorities of the regimental commander are adequately protected. However, the protection of the 3 combat trains is still marginal, and the protection of the air cavalry troop FARRP is inadequate. These deficiencies dictate that the present C/V battalion mix of 2 Chaparral/ 2 Vulcan batteries receive a similar analysis.

C/V Battalion Mix of 2 Chaparral/ 2 Vulcan Batteries

Further consideration of the greater range of the Chaparral can argue in favor of a more balanced C/V mix at squadron level. As in the case of the regimental CP and aviation assembly areas, an asset may not be specifically protected by a Chaparral platoon, but it can be located within the coverage of the system. In an assumed deployment of 2 Chaparral/ 2 Vulcan batteries in direct support of the 3d ACR, a 1 Chaparral / 2 Vulcan platoon battery mix can be achieved to protect the squadron.

In this case, the first priority of the howitzer battery presents the same problem of normal movement forward by echelon. Both a Vulcan and Chaparral platoon are assumed necessary to protect the howitzers (Map 5). This achieves both mix and mass. The second priority tank company retains its Vulcan platoon. Because of the relatively static nature of the field trains, the remaining pure Chaparral battery is better suited to provide protection for this large asset with the same benefits accrued as shown in Map 4.

With a Chaparral platoon protecting the howitzer battery, the squadron command post, combat trains, and air cavalry troop FARRP (if in the area) are positioned to fall within Chaparral coverage (See Map 5).

This takes the pressure off Redeye sections permitting greater flexibility in their employment. Among many possibilities, Redeye teams of the squadron are assumed here to support each command post, combat trains, armored cavalry troop, and the tank company.

Table 6 reflects the air defense adequacy based upon the preceding considerations. As shown, all critical assets have at least minimal protection. All priorities of the regimental commander are adequately protected. Because of the complementary mix of C/V platoons protecting howitzer batteries, and Chaparral defending field trains, Redeye can now supplement the air defense offered by SAFAD throughout the regimental zone of action.

Conclusion

Table 7 compares the adequacy of air defense of the three possibilities of C/V mix analyzed in this chapter. This table is summarized as follows:

Air Defense Protection	Without C/V	With 1 Chap, 3 Vulcan Btrys	With 2 Chap, 2 Vulcan Btrys
Adequate	9	20	23
Marginal	14	5	3
Inadequate	3	1	0

Total: 26 Critical Assets

Based upon this analysis, the following conclusion is reached. THE PRESENT C/V BATTALION MIX OF 2 CHAPARRAL AND 2 VULCAN BATTERIES IS THE BEST TO ADEQUATELY PROTECT THE ACR.

The 5th Bn, 59th ADA (C/V)(SP), is therefore ideal to support the 3d ACR in its mission as the advance covering force in the scenario; consequently, the regimental commander informs the corps G3 of his

Table 6

Air Defense Adequacy With 2 Chaparral/ 2 Vulcan Batteries

Critical Asset	No	Primary Air Defense	Secondary Air Defense	Adequacy of Air Defense
Regiment:				
Command Post	1	Passive	1 Redeye Team Limited SAFAD Chaparral*	Adequate
ACT Assembly Area	1	Passive	2 Redeye Teams** Chaparral*	Marginal
ACT FARRP(daytime)	1	Passive	(1 Redeye team**) Chaparral*	Marginal
HHT Aviation Plt	1	Passive	1 Redeye Team Chaparral*	Marginal
Field Trains	1	Chap Battery	Passive	Adequate
Squadron (3):				
Command Post	3	Passive	1 Redeye Team Limited SAFAD Chaparral*	Adequate
Combat Trains	3	Passive	1 Redeye Team Limited SAFAD Chaparral*	Adequate
Armd Cav Troop	9	Passive	1 Redeye Team SAFAD	Adequate
Tank Company	3	1 Vulcan Plt 1 Redeye Team SAFAD	Passive	Adequate
Howitzer Battery	3	1 Chaparral Plt 1 Vulcan Plt SAFAD	Passive	Adequate

* Indicates that whenever possible, critical asset will be located within range of Chaparral systems protecting a priority asset.
** One of the two Redeye teams provided the air cavalry troop may accompany FARRP elements.

Table 7

Comparison of Air Defense Adequacy

Critical Asset	Without C/V	With 1 Chaparral, 3 Vulcan Batteries	With 2 Chaparral, 2 Vulcan Batteries
Regiment:			
Command Post	Marginal	Adequate	Adequate
ACT Assembly Area	Inadequate	Marginal	Marginal
ACT FARRP	Inadequate	Inadequate	Marginal
HHT Aviation Plt	Inadequate	Marginal	Marginal
Field Trains	Marginal	Adequate	Adequate
Squadron:			
Command Post	Marginal	Adequate	Adequate
Combat Trains	Marginal	Marginal	Adequate
Armd Cav Troop	Adequate	Adequate	Adequate
Tank Company	Marginal	Adequate	Adequate
Howitzer Battery	Marginal	Adequate	Adequate

decision.

CHAPARRAL/VULCAN BATTALION INTERFACE WITH REDEYE

As noted, the balanced C/V battalion of 2 Chaparral and 2 Vulcan batteries permits a more flexible employment of Redeye. How these SHORAD capabilities interface is important. The presence of Redeye down to the troop/company/battery is significant in that professional air defense artillerymen are present at that level. Redeye must be able to integrate its command and control, as well as communications, with supporting C/V units to permit a centralized, responsive conduct of the SHORAD battle.

3d ACR--11th AD Group experience at Ft Bliss resulted in an arrangement which functioned extremely well. The Redeye section was placed under operational control (OPCON) of the supporting C/V battery commander.[14] Because of Redeye limitations (discussed in Chapter III), difficulties exist in communications; however, there is no problem if Redeye teams are provided the M113A1 with an adequate radio package.

The direct support C/V battery commander becomes the air defense officer of the squadron commander. In this capacity at Ft Bliss, the battery commander normally monitored both the tactical situation and the air battle from the supported squadron CP. This freed the Redeye section leader to better command and control his section.[15] By considering Redeye assets as well as his own, the C/V battery commander can more efficiently task organize to protect the critical assets specified in the commander's air defense priorities.

NONDIVISIONAL CHAPARRAL/VULCAN BATTALION DEFICIENCIES

As noted earlier, the nondivisional C/V battalion possesses towed Vulcan units. This configuration is totally inadequate to support the highly mobile ACR moving cross-country as an advance covering force or in a similar mission.

Based upon 3d ACR experience at Ft Bliss, the airspace control element (ACE) of the divisional C/V battalion is essential to integrate the air defense portion of the battle into the overall regimental orchestration of its combat and combat support assets.[16] The nondivisional C/V battalion lacks an organic ACE to provide this vital capability. Since the ACR would most likely receive its C/V support from the nondivisional battalion, an obvious requirement exists to restructure the battalion along the lines of the divisional C/V battalion. In this manner, the nondivisional battalion could provide the requisite SP Vulcan and ACE capability needed to support the ACR or any other maneuver unit.

CONCLUSION

FOR ADEQUATE SHORAD PROTECTION FROM LOW ALTITUDE AIR ATTACK, THE ARMORED CAVALRY REGIMENT REQUIRES A DIVISIONAL-TYPE CHAPARRAL/VULCAN BATTALION.

RECOMMENDATIONS

Based on the discussion of this chapter, recommendations are as follow:

1. The nondivisional C/V battalion should be reorganized to include SP Vulcan systems and an airspace coordination element (ACE), thus becoming identical to the C/V battalion of the armored or mechanized division.

2. Chaparral/Vulcan/Redeye SHORAD systems should be upgraded to include a night engagement capability; follow-on systems should be designed for night as well as day engagement of aerial targets.

ENDNOTES

[1]U.S. Army Air Defense School, Army Air Defense, An Overview for the Commander (Ft Bliss: [n.d.]), pp. 5-7.

[2]Ibid., p. 5.

[3]Ibid., pp.5-6.

[4]U.S. Army Command and General Staff College RB 100-2, Vol II, C 1, Selected Readings in Tactics: Reference Data Selected U.S. and Soviet Weapons and Equipment (Ft Leavenworth: 23 July 1974), p. 15-47.

[5]U.S. Army Armor School, The Cavalry/Scout Study (U), Vol IV (Ft Knox: July 1974), p. J-6.

[6]LTC William O. Staudemaier, "Air Defense for Armored Leaders," Armor, LXXXIII (Mar-Apr 1974), 42.

[7]U.S. Army Armor School, op. cit., p. J-5.

[8]U.S. Army Command and General Staff College RB 100-2, op. cit., p. 15-46.

[9]Staudemaier, loc. cit.

[10]DA Field Manual 44-1, U.S. Army Air Defense Employment (Washington: Government Printing Office, 6 February 1970), p. 7-10.

[11]Headquarters, 11th Air Defense Artillery Group, FTX Brave Rifles VII Comments (Ft Bliss: [n.d.]), p. 3.

[12]COL David K. Doyle and COL Montgomery Speir, Airspace Management and Air Defense Results during FTX Brave Rifles VII, 18-25 February 1974 (Ft Bliss: 5 April 1974), p. 4.

[13]Gerron, SHORAD Weapons Mix Organic to an Armored Cavalry Regiment (Ft Bliss: 7 March 1973), pp. 2-3.

[14]Doyle and Speir, op. cit., p. 3.

[15]Ibid., pp. 3-4.

[16]Headquarters, 3d Armored Cavalry Regiment, After Action Report of JTX Brave Shield VI, 24-31 October 1973 (Ft Bliss: January 1974), p. B-6.

CHAPTER V: SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

SUMMARY OF CONCLUSIONS

Short-Range Air Defense (SHORAD)

FOR ADEQUATE SHORAD PROTECTION FROM LOW ALTITUDE AIR ATTACK, THE ARMORED CAVALRY REGIMENT REQUIRES A DIVISIONAL-TYPE CHAPARRAL/VULCAN BATTALION.

Redeye

1. The SHORAD capability of Redeye should remain organic to the squadron and the regimental headquarters troops for maximum responsiveness to the commander.
2. Incapable of area defense, the Redeye section can protect a single critical asset or supplement the SAFAD capability of each troop/company/battery of the regiment.
3. As currently equipped in the ACR, Redeye lacks the requisite mobility, survivability, and communications to perform its mission.

Small Arms for Air Defense (SAFAD)

1. As a supplement to passive and other active air defense measures, properly employed SAFAD can degrade a Soviet air attack by the destruction of aircraft or the psychological effect of tracers employed in volume fire.
2. The armored cavalry regiment, with 3556 automatic weapons ranging from 5.56mm to 20mm, has an enormous SAFAD capability.
3. The highest percentage (69%) of 7.62mm to 20mm automatic weapon

capability of the regiment is concentrated in the 9 armored cavalry troops.

4. Realistic, effective training in the volume fire technique, as outlined in Test TC 23-44, must be conducted to produce soldier confidence and an instinctive, aggressive reaction to air attack.

5. Reflecting an apathetic attitude toward SAFAD in the past, current U.S. Army automatic small arms lack efficient, effective sights and mounts for employment against aerial targets.

Passive Air Defense

1. Night tactical and resupply operations are the best passive air defense measure.

2. Passive air defense measures can effectively become the primary air defense for:

a. Dispersed armored cavalry troops moving cross-country.

b. Small, effectively camouflaged combat trains.

c. Small, effectively camouflaged mobile command posts which do not have "antenna farms" or helicopter signatures.

3. Passive air defense measures are necessary but least effective for:

a. The large regimental field trains.

b. Howitzer batteries because of their smoke signatures and relative lack of dispersion.

c. Helicopter assembly areas and FARRPs because of the dust and movement upon take-off and landing and the difficulty of camouflaging the aircraft.

The Low Altitude Air Threat

1. High Performance Aircraft: In large numbers, the SU-7B, augmented by

the MIG-21MF and MIG-23, will be the most likely aircraft to attack ACR targets.

2. Ordnance: Although nuclear capable, conventional bombs, rockets, cannon and CBU are the likely ordnance carried by Soviet aircraft.

3. Priorities: The Soviets will most likely attack in order of priority: (1) howitzer batteries; (2) tank companies; (3) command posts; (4) cavalry troops.

4. Tactics: Flying at low altitude, a flight of four Soviet aircraft will be the most likely formation to attack a single target. Operating in elements of two aircraft each, the first element may "popup" to divert defenders from the second element which will attack using low level/low angle of release tactics. Multiple passes are possible. Illuminated night air attacks can be expected.

5. Helicopter Employment: The ACR must consider vertical envelopment by heliborne infantry, possibly escorted by armed helicopters. Night heliborne attacks are highly probable.

6. Potential Effectiveness: Unrestricted, the Soviet tactical air force can deny the ACR mobility of the battlefield, destroy its heaviest armor, and thereby degrade mission accomplishment. Even the heaviest air defenses will not preclude some damage by determined attacks over a sustained period.

7. Vulnerabilities: Soviet close air support aircraft and helicopters are highly vulnerable to integrated LOMAD/SHORAD/SAFAD systems along the FEBA. High loss rates from these systems would benefit the ACR in that:

a. Air defense units may become an attack priority second only to the nuclear capable howitzer batteries, thus taking pressure off the combat elements.

b. Soviet bombing accuracy would most likely be degraded.

c. Reconnaissance and attack of targets of opportunity ("hunting" technique) would be severely curtailed.

d. The armored cavalry regiment would have a greater assurance of mission accomplishment.

Air Defense in Armor Publications

The existing air defense doctrine in Armor publications is generally scanty, out-dated, and often erroneous.

SUMMARY OF RECOMMENDATIONS

Short-Range Air Defense (SHORAD)

1. The nondivisional C/V battalion should be reorganized to include SP Vulcan systems and an airspace coordination element (ACE), thus becoming identical to the C/V battalion of the armored or mechanized division.
2. Chaparral/Vulcan/Redeye SHORAD systems should be upgraded to include a night engagement capability; follow-on systems should be designed for night as well as day engagement of aerial targets.

Redeye

1. The U.S. Army Armor School should strongly support the recommendation of the U.S. Army Air Defense School that all Redeye teams assigned to armored and mechanized units be provided the M113A1. Additional consideration should be given to eliminating the M561 of the section leader and providing him a M113A1, as first preference, or the M151 with trailer as second preference.
2. All Redeye teams should be provided the AN/VRC-47 with the auxiliary FM receiver for early warning, etc. Upon development and issuance of an

AM early warning receiver, the Redeye team should be equipped with the AN/VRC-46 (no auxiliary FM receiver).

3. The Redeye section leader should be issued an RC-292 antenna to improve his command and control of Redeye teams operating over extended distances.

Small Arms for Air Defense

1. Current armor doctrinal publications should be updated to adequately include SAFAD considerations and amplify the techniques outlined in Test TC 23-44.

2. All armor training, ammunition allocations, and unit performance evaluations should include SAFAD.

3. Current automatic small arms and mounts of the U.S. Army should be modified, where possible, to improve sighting and ease of employment against aerial targets.

4. The design of future U.S. Army small arms used for air defense should incorporate efficient sights and mounts for aerial target engagement.

5. Consideration should be given to increasing the percentage of tracer rounds in linked automatic weapon ammunition.

Passive Air Defense

1. U.S. Army efforts to develop, procure, and issue light-weight, radar-energy absorbing camouflage nets for each tactical vehicle and aircraft should be accelerated.

2. A means to effectively camouflage a helicopter windscreen should be developed.

3. To reduce the visual and electronic signature of CPs, a requirement

exists for a means to remote a RC-292 antenna 1-2 km from its radio.

4. Future design of combat vehicles should include a means to reduce the diesel smoke signature of exhaust systems.

5. If technically feasible, a smokeless propellant should be developed for howitzers.

Air Defense in Armor Publications

All armor (17-series) publications should be reviewed for their air defense content and updated where necessary.

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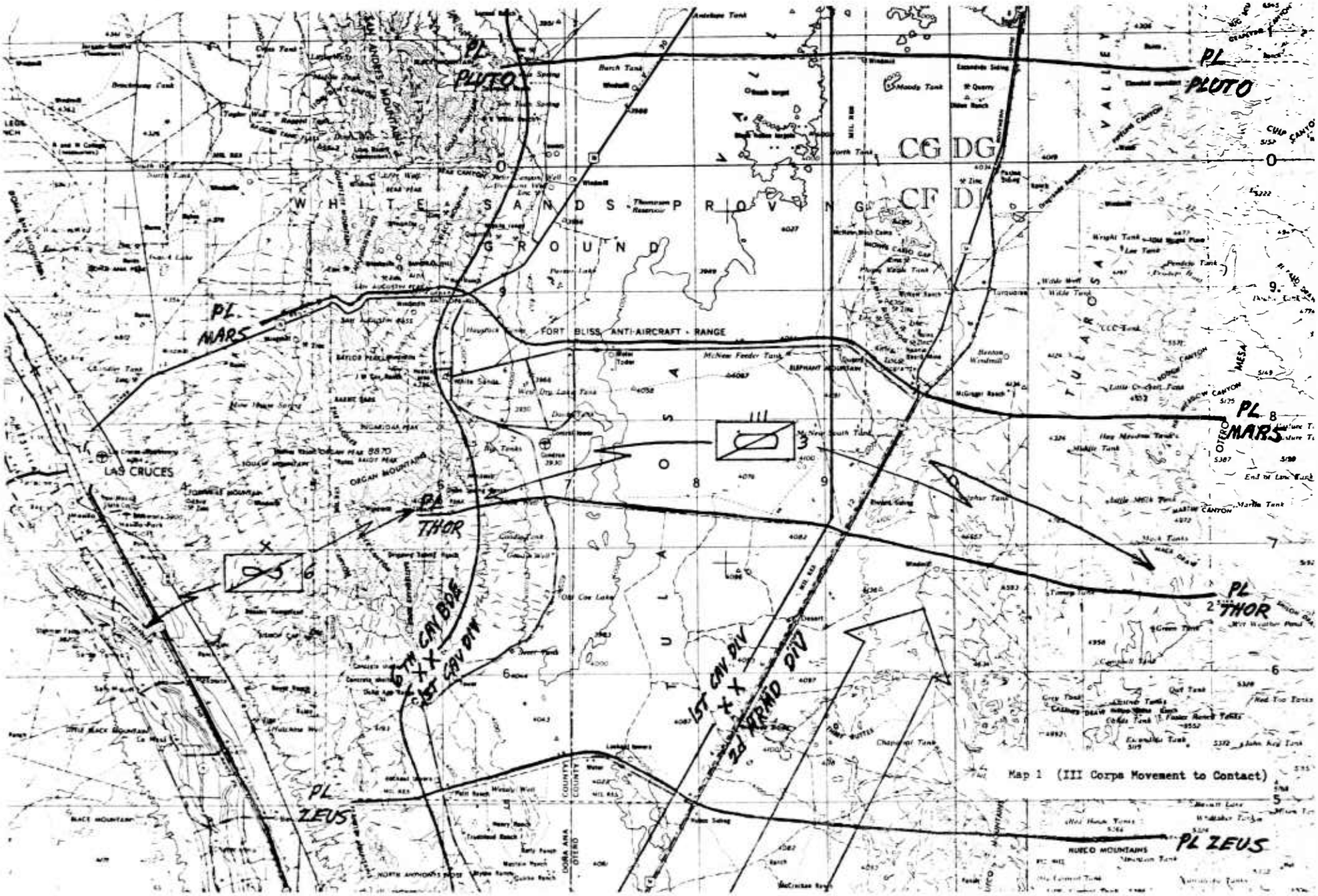
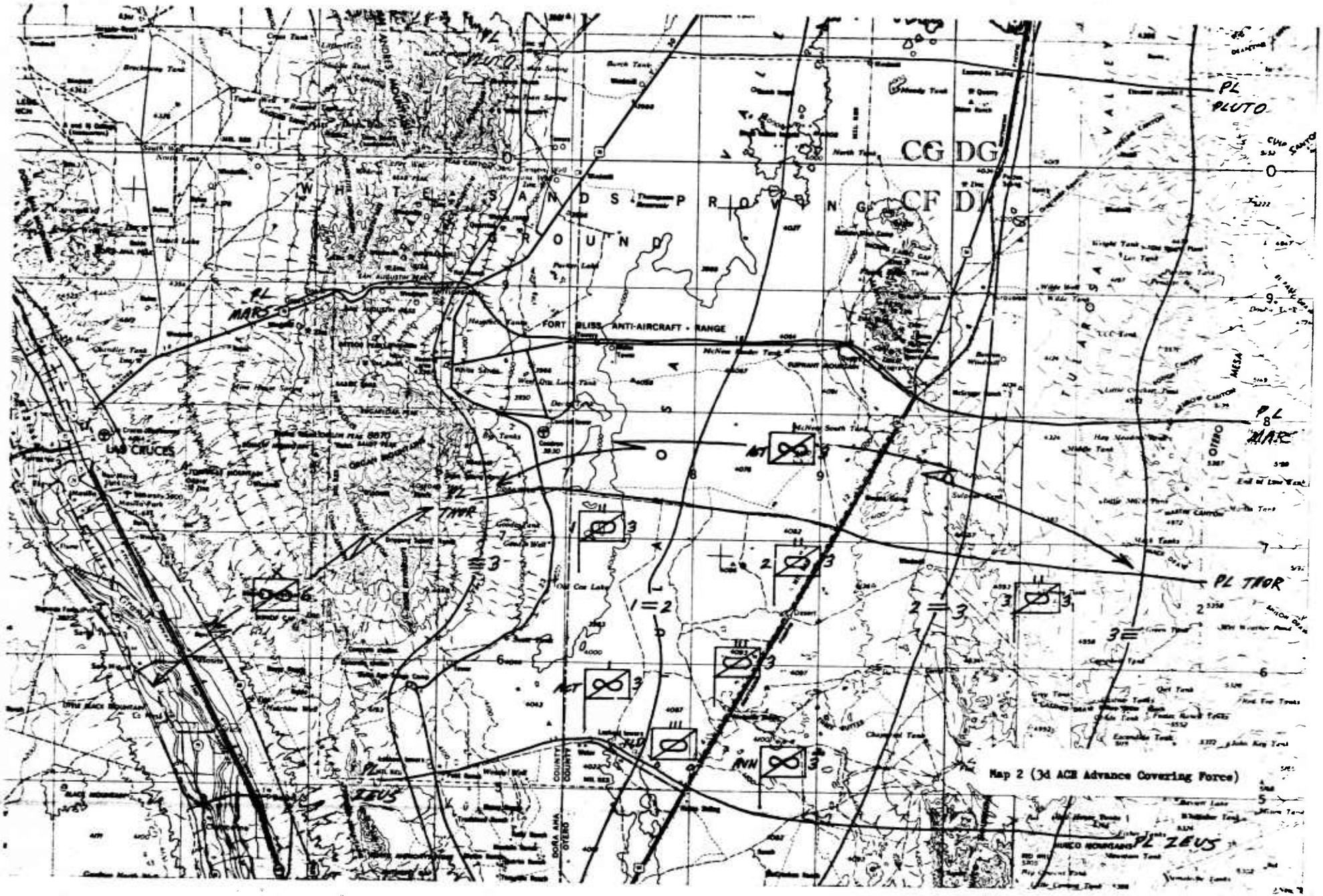
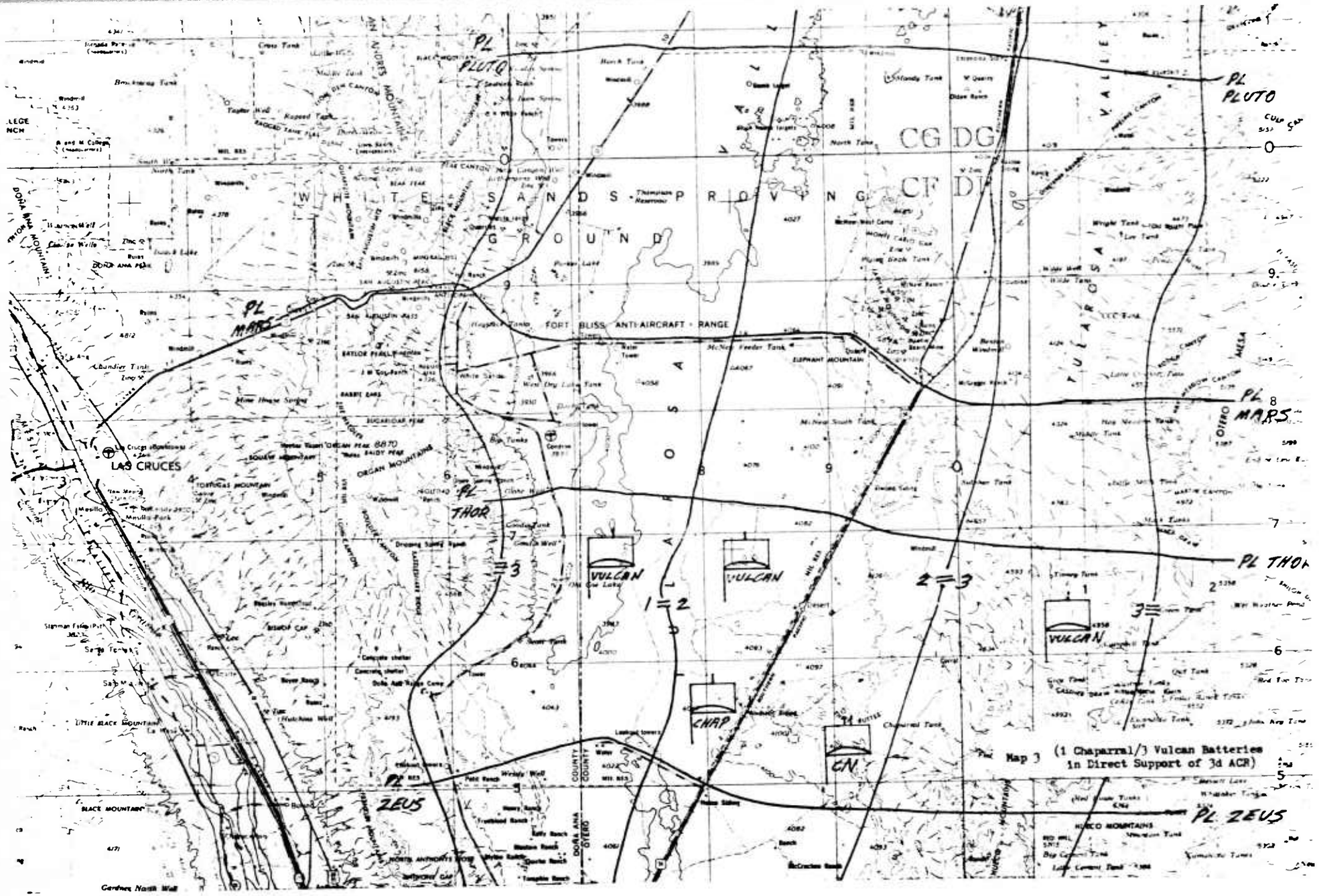
MAPS

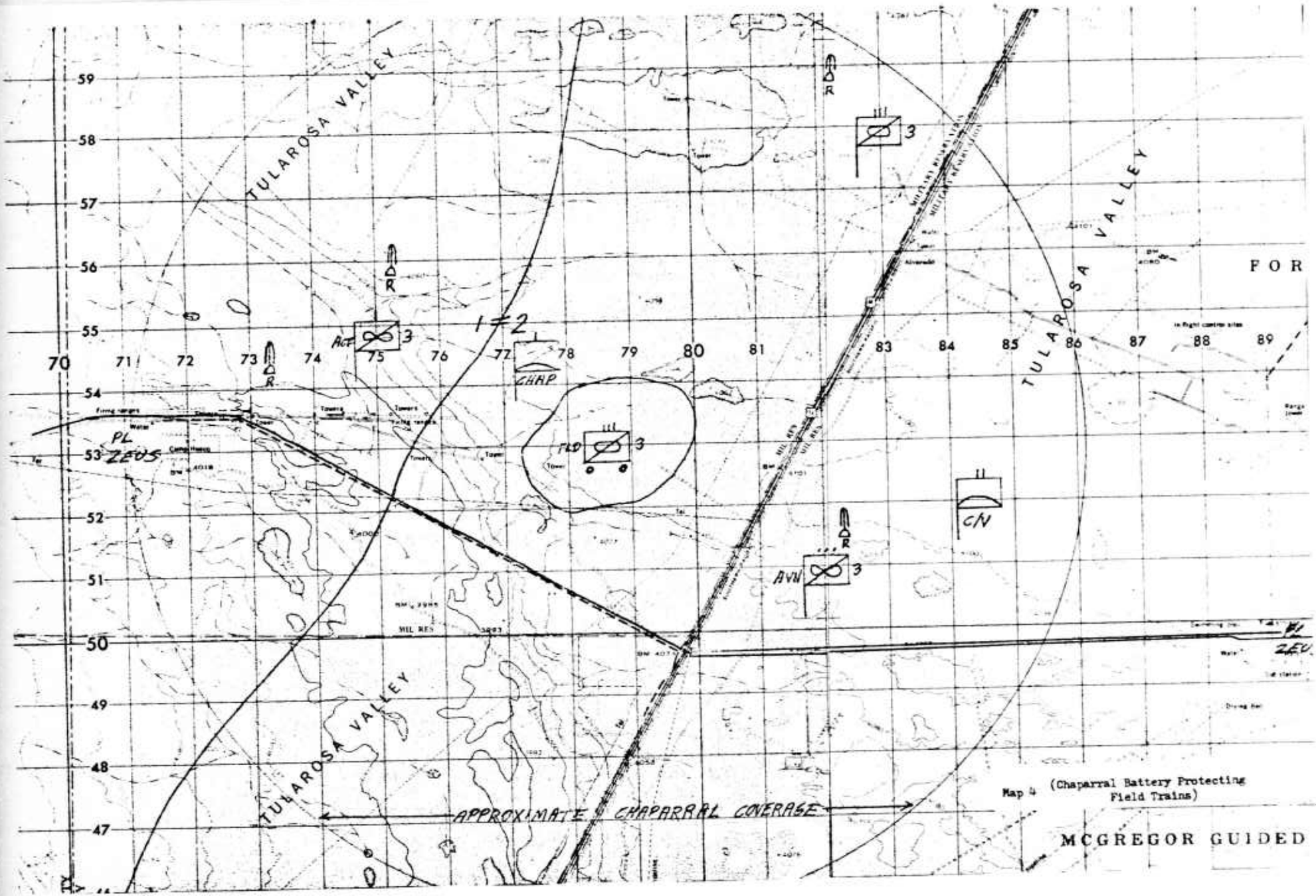


Map 1 (III Corps Movement to Contact)

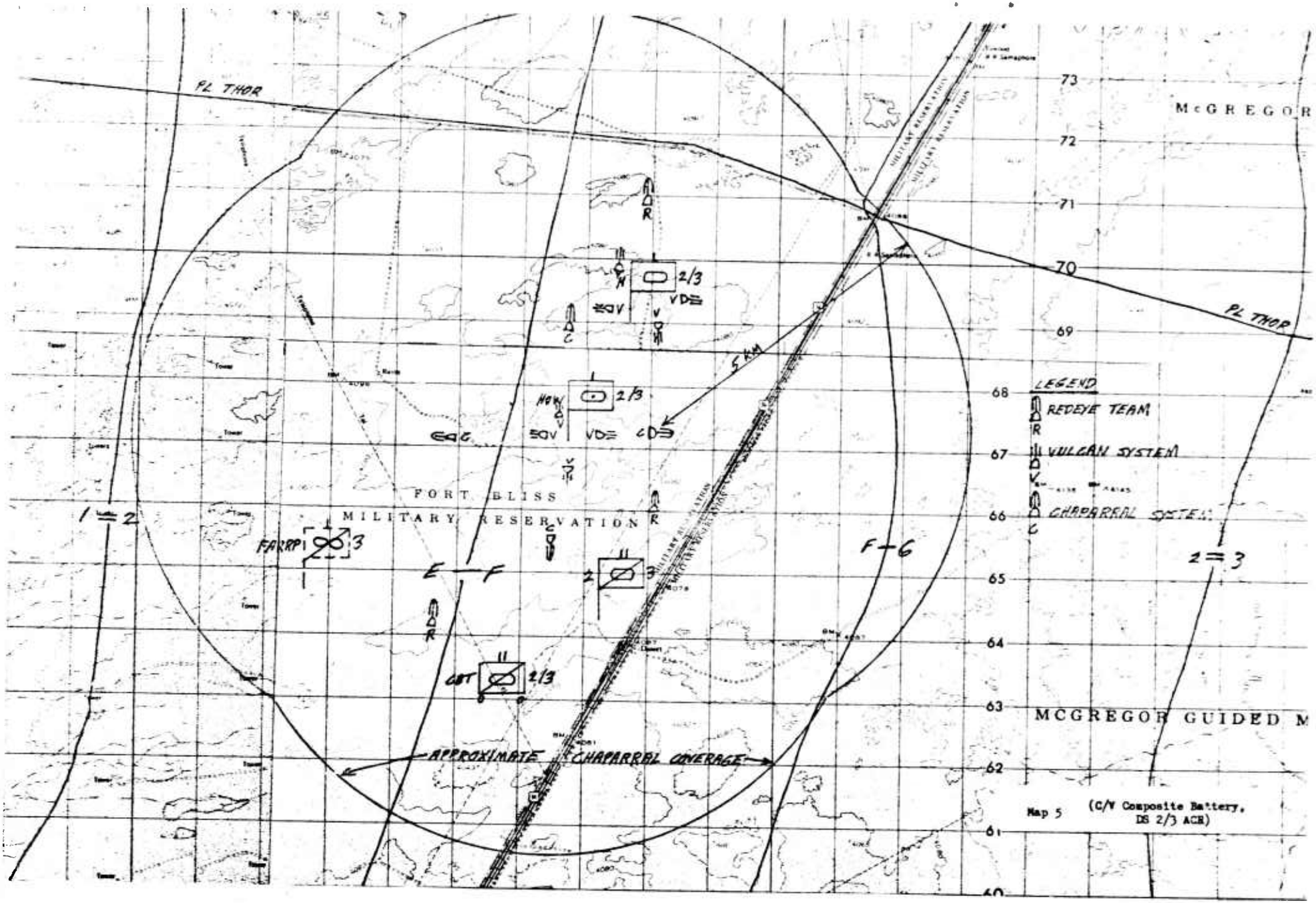


Map 2 (3d ACR Advance Covering Force)


PL PLUTO
PL MARS
PL THOR
PL ZEUS
FORT BLISS ANTI-AIRCRAFT RANGE
WHITE SANDS PROVING GROUND
LAS CRUCES
ORGAN MOUNTAINS
VULCAN
VULCAN
VULCAN
CHAP
CN
Map 3 (1 Chaparral/3 Vulcan Batteries in Direct Support of 3d ACR)



Map 4 (Chaparral Battery Protecting Field Trains)



Map 5 (C/V Composite Battery, DS 2/3 ACR)